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A TAXONOMIC STUDY OF LECHEA

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(Plates 488-491)

LINNAEUS¹ had in his genus *Lechea* two species, *L. minor* and *L. major*. The type of the latter has long been known to belong to *Helianthemum*. The description of *L. minor* is generalized and that name is given in the Linnean Herbarium to specimens of several species. The specimen selected as the type by Britton² was the one labeled "*Capraria fol. integerrimis, fl. virg.*", this being the name given by Gronovius to one of the plants cited by Linnaeus.

Michaux³ described three new species, two of which, *Lechea racemulosa* and *L. tenuifolia*, still stand. The other was *L. thymifolia*, the plant we now call *L. minor*. The *L. minor* of Michaux and most later authors, until Britton, included several of our northeastern species. Poiret⁴ largely followed Michaux, except for the inclusion of *L. verticillata* and *L. chinensis* (two plants of the orient quite unrelated to *Lechea* as now interpreted) and the elimination of *L. minor*. Of *L. thymifolia* Michx. Poiret states, "Il est à presumer, mais sans une certitude absolue, que cette plante est le *Lechea minor* de Linné." Pursh⁵ followed Linnaeus and Michaux in regard to names but, whereas the latter's *L. thymifolia* is our *L. minor*, that of Pursh is our *L.*

¹ Sp. Pl. 90 (1753).

² Bull. Torr. Bot. Cl. xxi. 247 (1894).

³ Fl. Bor.-Am. i. 76, 77 (1803).

⁴ Encyc. Meth. Suppl. iii. 340, 341 (1813).

⁵ Fl. Am. Sept. i. 90 (1814).

maritima. This conclusion is largely arrived at through the examination of types which, in the case of the older species, have been seen by Britton.¹ The early descriptions are generally inadequate and generalized as are the early drawings. Elliott² gave the name *L. villosa* to the plant which had until then been called *L. major*. He pointed out the fact that the *L. major* of Linnaeus was a *Helianthemum*. The other species recognized by Elliott were *L. racemulosa*, *L. tenuifolia* and *L. thymifolia*, the last of which, by the description, is our *L. minor*. Smith³ interpreted the Linnean *L. minor* to be the plant we call *L. villosa*. He followed Elliott in ruling out the *L. major* of Linnaeus. Otherwise he followed Michaux, except that he included the unrelated *L. verticillata*. Dunal⁴ used the name *L. villosa* of Elliott in place of *L. major*. He otherwise too largely followed Michaux, except that his concept of *L. thymifolia* was partly that of Pursh. The American authors of the first half of the 19th century, except Torrey and Rafinesque, largely accepted Michaux's species and, in fact, mostly borrowed literally from his work or from that of Pursh. Torrey,⁵ in 1824 recognized four species, *L. major* L., *L. minor* L., *L. racemulosa* Michx. and *L. thymifolia* Pursh.

Rafinesque's monograph of *Lechea*⁶ is an interesting but entirely perplexing piece of work. In it Rafinesque first stressed the value of the length of the "external calix" in relation to the internal, also the importance of the number of seeds per capsule. The number of stamens, he believed, was still another valuable character and perhaps this view was in part responsible for the deplorable state in which he left the genus. He made three subgenera.

1. "MENANDRA, Fl. Virg. of Gronovius. External calix with 2 short sepals or almost lacking. Stamens 6 to 9, seeds 1 to 3. *Leaves often ternate, and flowers racemose. Perennials.*" 2. "LECHEA, Ext. calix equal in length to the internal. Stamens 6 to 12, seeds 1 to 3, *flowers spicate, paniculate, some stems sterile.*" 3. "EUDIEXA Raf. (well 2 external) Ext. calix longer than the internal. Stamens 3 to 6. Seeds 3 to 9. Chiefly annuals."

Rafinesque thereupon proceeded to describe 21 species (20 of them new), only four of which I have been able to correlate definitely with any known species. It is apparent that he could not discriminate in

¹ Bull. Torr. Bot. Cl. xxi. 245 (1894).

² Sk. Bot. S. Car. and Ga. 184 (1816).

³ Rees's Cycl. 20 (1819).

⁴ DC. Prod. i. 285 (1824).

⁵ Fl. N. and Mid. St. i. 160, 161 (1824).

⁶ New Fl. N. Am. i. 89-98 (1836).

value between those characters which he stated to be important and those which we know to vary with external conditions.

Spach¹ treated *Lechea villosa* as *L. Drummondii*, believing it to have been hitherto undescribed, and *L. tenuifolia* as *L. thesioides*, believing that to be a new species. Furthermore he made an entirely new genus *Lechidium* to include a remarkably distinct species from Texas, which he named *Lechidium Drummondii*.

Torrey and Gray² had two varieties, α and β ., of their *Lechea minor*. Their concept included *L. racemulosa* Michx., *L. thymifolia* Michx. (our *L. minor* L. probably), and *L. tenuifolia* Michx. Their *L. thymifolia* is the plant we call *L. maritima*, rather than the plant to which Pursh had given the name. They made the new combination *Lechea Drummondii* of Spach's *Lechidium Drummondii*, overlooking the fact that there was already a *Lechea Drummondii* published by that author. Torrey³ in 1843 recognized three species, *L. minor* having two named varieties 1. *dumosa*, 2. *gracilis*, which were *L. tenuifolia* and *L. racemulosa* respectively.

For a period of thirty years or more after Torrey's Flora of the State of New York appeared, there was very little published on the genus. Gray satisfied himself in the first four editions of the Manual with recognizing three species, those of Torrey & Gray's Flora excepting *Lechea Drummondii*. In 1867 we find him⁴ publishing for the first time the name *L. novae-caesareae* Austin for our *L. minor* L.

In 1878 there appeared a discussion of Rafinesque's Monograph by W. H. Leggett.⁵ On pages 251 and 252 he published the first lucid key that had yet appeared, making use of the better of Rafinesque's characters and stressing, in particular, the proportions of the basal leaves. Here were described *Lechea patula* and *L. cubensis* for the first time. Leggett pointed out that *L. thymifolia* of the early editions of Gray's Manual must receive another name. He also showed that the so-called *L. minor* Lam. did not properly include *L. racemulosa*, *L. tenuifolia* and *L. thymifolia* but did cover one or more previously undefined species of the northeastern United States. In all, Leggett recognized ten species and several variants which, however, he did not name. He pointed out the weaknesses and effective

¹ Hook. Comp. Bot. Mag. ii. 282-289 (1837).

² Fl. N. Am. i. 153, 154 (1838).

³ Fl. N. Y. i. 78, 79 (1843).

⁴ Gray's Man. ed. 5: 81 (1867).

⁵ Bull. Torr. Bot. Cl. vi. 246-252 (1878).

points of Rafinesque's work and noted the difficulties involved in recognizing his species. This treatment brought Leggett recognition as the outstanding student of the genus for several years. He published little but before his death in 1882 he had gone over with Britton¹ Rafinesque's study on the group and had given tentative names to many new species.

Gray's (or perhaps Watson's)² views on the species within the manual-range appeared in 1890. Here were included *Lechea major*, *L. tenuifolia*, *L. racemulosa*, *L. minor* and *L. minor* var. *maritima*.

Chapman³ published *Lechea cinerea* Raf. and *L. cinerea* var. *Torreyi*, one of the first of the complexes of a species and its variety to be satisfactorily treated. It was with Leggett's work as a basis that Britton⁴ in 1894 published his monograph, the most penetrating piece of work to appear on the genus. The following species were here described for the first time but were attributed to Leggett, *L. intermedia*, *L. Torreyi*, *L. stricta* and *L. divaricata*. The new combination *L. tripetala* (Moc. & Sess.) Britton was made. The name *L. maritima* for *L. thymifolia* Pursh was established and the species *L. Leggettii* was given clear delineation. Altogether fourteen species were described but no varieties were recognized.

Robinson's treatment,⁵ generally speaking, was a scholarly piece of work but technically based largely on Britton's monograph, as is stated in a footnote.⁶ It included only the species of the United States and Canada (11 in all) and consequently omitted *Lechea cubensis* and *L. tripetala*. Chiefly on the basis of type of pubescence he chose, following Gray, to make the very distinct *L. divaricata* a variety of *L. villosa*. Unlike Britton, he retained the subgenus *Lechidium*.

Bicknell⁷ described *Lechea juniperina* from the coast of Maine. This was included in the treatment of the genus by Britton and Brown.⁸ In the latter work are descriptions of nine species accompanied by figures showing the panicles, basal shoots, capsules and calyces. The illustrations in common with all those of the genus

¹ Bull. Torr. Bot. Cl. xxi. 245 (1894).

² Gray, Man. ed. 6: 77, 78 (1890).

³ Fl. S. U. S. ed. 2, Suppl. 2: 678 (1892).

⁴ Bull. Torr. Bot. Cl. xxi. 244-253 (1894).

⁵ Syn. Fl. N. Am. i¹ 192-194 (1895).

⁶ Syn. Fl. N. Am. l. c., 192 (1895).

⁷ Bull. Torr. Bot. Cl. xxiv. 88 (1897).

⁸ Ill. Fl. ed. 1, ii. 441-444 (1897).

except in Gray's *Genera*¹ are crude and frequently inexact. The basal leaves of *L. intermedia* in Britton & Brown are shown to be as broad proportionally as those of *L. maritima*, whereas, in the description they are given as 4''–5'' long, $\frac{1}{2}$ '' wide for the former and 3''–4'' long, $1\frac{1}{2}$ ''–2'' wide for the latter. Actually they are of about equal proportions in both and more than three times as long as broad and not, as stated in the key for *L. maritima*, "Leaves of the basal shoots oblong or ovate, not more than three times as long as broad." Britton's latest exposition of the genus,² in 1901, was largely that of his earlier works except for the inclusion of Bicknell's *L. moniliformis*, published for the first time.

The most recent work on *Lechea* in its entirety is that of Grosser.³ It has more complete citations of specimens and literature than any previous work. The author retains the name *L. major* for *L. villosa* and makes of it two varieties, var. α . *villosa* and var. β . *divaricata*. He maintains *Lechidium* as a section and includes in it the species *L. san-sabeana*. There are thirteen species taken up in this work.

Small⁴ included *Lechea maritima* among the ten species recognized within the range of his Flora; but as far as I have found it does not occur south of Virginia. The very distinct *L. Drummondii* was not placed in a separate subsection or subgenus. Generally speaking his treatment of 1903 was sane and conservative.

Robinson and Fernald⁵ maintain eight species in the manual-range. *Lechea juniperina* is reduced by Robinson to the status of a variety and *L. moniliformis* is cited as a synonym of *L. Leggettii*. Robinson describes *L. maritima* var. *interior* which tends to confuse rather than clarify that particular complex.

Small's recent treatment⁶ is a very radical piece of work. In the first place, of the fourteen species there appearing five are of his own making. These are *Lechea cernua*, *L. exserta*, *L. myriophylla*, *L. prismatica* and *L. Deckertii*, the first and last named of which were published earlier and are satisfactory species. The three remaining were there described for the first time. *L. prismatica* and *L. exserta* I include with *L. patula*, *L. myriophylla* with *L. Deckertii*. Small makes five sections: I. *Longisepalae*, with five species; II. *Brevisepalae*,

¹ *Genera* Ill. i. 205, 206, pls. 88 and 89 (1848).

² *Man.* ed. 1: 631–633 (1901).

³ *Engler, Pflanzenr.* iv¹⁹³. 133–140 (1903).

⁴ *Fl. Se. U. S.* 798, 799 (1903).

⁵ *Gray's Man.* ed. 7: 577–579 (1908).

⁶ *Man.* 881–884 (1933).

with four species; III. *Cernuae*, with one species; IV. *Divaricatae*, with one species; V. *Myriophyllae*, with two species. *L. prismatica* is placed by Small in the *Longisepalae*, *L. exserta* in the *Brevisepalae*; yet, I consider both of these forms of *L. patula* which he places in the *Longisepalae*. In his work no varieties are recognized.

Plants of *Lechea* are generally perennial but they are frequently biennial in the northern United States and in Canada or they may fruit on abbreviated stems at the end of the first season. In the South, generally, the plants are strongly perennial to suffruticose. The same species, *L. villosa* var. *typica* for example, may in the North be biennial, with a virtually unbranched caudex, and in the South become strongly perennial, with a greatly branched caudex. Generally speaking, however, the suffruticose habit is confined to several very distinct subtropical species and the biennial nature appears where winters are severe.

The ROOTS offer no characters of importance. They are very crooked, with short stout branches and are essentially similar throughout the genus.

The BASAL SHOOTS are of particular interest and importance. They are called by Britton¹ "sterile radical shoots"; Grosser² calls them "rami steriles basales." They have been spoken of mostly as basal shoots and I shall so call them in this paper. In the suffruticose species, *Lechea Deckertii*, *L. tripetala* and *L. cubensis*, they are wanting. The new shoots appear sporadically as branches in such cases. *L. patula*, *L. divaricata* and *L. villosa* in the southern part of their ranges all have an extensive branching caudex. In the season of vegetative development the new shoots appear from any part of the caudex but frequently from towards its base. Except that they undergo no rest-period they are quite comparable to the basal shoots of the northern species, which branch from all sides of the contracted caudex, forming a rosette. They develop from late in August until late in November, the time of appearance depending in part on the species and partly on the maturity of individuals. Basal shoots persist for many months at a certain stage of development which appears to be definite for each species. They offer one of the most certain means of identifying the species in which they undergo a definite period of dormancy.

The BASAL LEAVES (the leaves of the basal shoots) are crowded and

¹ Bull. Torr. Bot. Cl. xxi. 246 (1894).

² Engler, Pflanzenr. iv¹⁹³. 137 (1903).

strongly reduced in size. In quality and quantity of pubescence they are similar to the very mature cauline leaves. The basal leaves are more reduced in length than in breadth, making them proportionately broader than the cauline. Generally they are simple but in *Lechea villosa* var. *typica* and in *L. tenuifolia* (particularly in the latter) they are branched.

The FRUITING STEM results either from the renewed growth of the simple basal shoots or from one of its branches, when they occur. The transition from basal shoots to fruiting stems is abrupt in the North except in one or two instances, notably *Lechea intermedia* var. *depauperata* of the Lake Athabasca region, which is growing in a climate so much more severe than ours that comparison of its manner of growth with that of our species is difficult. In the broad-leaved species (comparatively speaking) of Florida we find the most complicated series of growth-stages. The new branches may be from the base or above, on the caudex, and may or may not have undergone dormancy; but in either instance they are related morphologically to basal shoots. *L. patula* illustrates the complexity of growth. The dormant shoots are frequently simple and have small narrowly elliptic-oblong leaves. During development which, in suffruticose types such as this, is very slow, the shoots become much branched and bear much larger leaves but otherwise simulate the resting condition. The mature fruiting stems have a still different type of leaf, narrower and less densely pilose.

The PUBESCENCE in the genus is all of one kind. Solereder¹ describes the peculiar falsely bicellular hair which he states is well known also in the *Combretaceae*. Kearney² figures a hair of this nature from *Lechea maritima*. It is presumably the only kind that he observed since he describes this type as characteristic and mentions no other. In my own observations on the genus I have seen no stellate or glandular hairs nor in fact any but a uniform type. Janchen³ states that the "Deckhaare" are "einfach." Kearney, l. c. p. 498, describes three types of hairs for *Helianthemum*, the type mentioned above as well as stellate, pluricellular and multicellular, glandular hairs. Of *Hudsonia*, however, Kearney, l. c., referring to the peculiar hairs of *Lechea*, states, "Hairs similar to those just described form the dense covering of the leaves of *Hudsonia tomentosa*."

¹ System. Anat. 91 (1899).

² Contrib. U. S. Nat Herb. (Bot. Dismal Swamp Region, 497) v. 497 (1901).

³ Engler & Prantl, Nat. Pflanzenfam. ii²¹, 301 (1925).

The DISPOSITION OF THE PUBESCENCE, particularly on the leaves, is rather complicated and of considerable value taxonomically. The species *Lechea cernua* and *L. villosa* display the greatest extent of pilosity. All leaves of the former are strongly pilose to tomentose above and below. *L. villosa* var. *Schaffneri* from Mexico is likewise strongly pilose on both leaf-surfaces. The southern subshrubby plants of *L. villosa* var. *typica* also bear leaves which are strongly pilose above. The upper surfaces of leaves of northern *L. villosa* var. *typica* are usually only slightly pilose. In this species the basal shoots, when well developed, bear leaves which are glabrous above. When hairs occur on the upper surface they are scattered over the entire surface. On the lower surface they may be distributed generally but in such cases are more concentrated on the midrib and the margin. In the larger number of species they are confined to the midrib and the margin. *L. villosa* and to a less extent *L. maritima* display most of the degrees of pubescence during their development.

The QUALITY OF PUBESCENCE varies somewhat. The hairs are short and decidedly appressed in *Lechea intermedia*; they are long and spreading in *L. villosa*. Various intermediate types occur between the two. Buds, young shoots and branches are always strongly or densely pilose or tomentose to villous.

The SIZE OF THE PLANT differs considerably in the various species and varieties. *Lechea intermedia* var. *depauperata* has semiprostrate fruiting stems a few cm. long. *L. Leggettii* var. *ramosissima* may be 80 or more cm. in height. The branches may be broadly, at times horizontally spreading, forming a loose globose panicle, as in the last named variety, or suberect and contracted into a dense spire-shaped panicle, as in *L. stricta*. In general the shape of the panicle may vary considerably within certain limits.

The ARRANGEMENT OF THE FRUITS is a fairly definite character for each species or variety. *Lechea villosa* var. *typica*, for example, has fruits in crowded heads. The pedicels, which are short, are appressed to strongly spreading or reflexed in relation to the axis, in this way allowing a maximum amount of concentration on the short fruiting branches. The disposition of the fruits undergoes considerable modification within species in different geographic areas. Thus, the northeastern and inland *L. Leggettii* var. *typica* usually has the fruits definitely crowded at the top of the fruiting branches. Var. *moniliformis* of the northern Coastal Plain and the Great Lakes region has

them predominantly evenly distributed, or nearly so, on much longer branches; while var. *ramosissima* of the southern Coastal Plain has them evenly distributed but scattered on very long fruiting branches. *L. Torreyi* has the fruits racemose and mostly evenly distributed on but slightly crooked branches, whereas var. *congesta* has short and very crooked fruiting branches which bear the fruits in close racemes or clusters. At least two special examples of fruit-arrangement are worthy of brief mention here. *L. cernua* has the fruits in clusters of a few each. They are not crowded but, nevertheless, are appressed, spreading or reflexed upon the axis in a peculiar manner certainly suggesting the position of the pedicels in the crowded clusters of *L. villosa* for example. *L. san-sabeana* of the subgenus *Lechidium* has its fruits strongly secund and widely scattered on the very long branches and borne at right angles to the axis on very long pedicels.

The FRUITS offer the best characters for taxonomic study. The slight differences, however, in shape and size of calyx-parts, capsules and seeds make it difficult for one to describe distinctions which actually exist and are, furthermore, very apparent to a student of the genus. The differences are slight, not only between species and varieties but between true species and also between groups of species. For example: a rather fundamental character in the genus is the shape of the calyx, whether it is broader toward the base than above or whether it is broader toward the tip or above the middle and narrows in one way or other toward the base. Four species, which in other respects have striking similarities, have the calyx distinctly broadest below the middle and toward the base. These are *Lechea san-sabeana*, *L. tenuifolia*, *L. mensalis* and *L. tripetala*. The calyces of the other species, while broadly globose at times, have an obconic base merging into the pedicel. Generally these species have pyriform or cuneate-obovoid to cuneate-globose fruits.

The CALYX is composed of five sepals in two very dissimilar series, an outer two which are bracteole-like and an inner three constituting the prominent calyx. That the outer two are sepals and not bracteoles is stated by Grosser¹ "Die beiden äusseren . . . sind von manchen Autoren als Vorblätter gedeutet worden, eine Ansicht, deren Richtigkeit stark in Zweifel gestellt wird einerseits durch das Vorhandensein eigentlicher Vorblätter, andererseits durch die bisweilen mächtige Entwicklung der äusseren Kelchblätter, wie bei

¹ Engler, Pflanzenr. iv¹⁹³. 5 (1903).

einigen Arten von *Cistus* und *Tuberaria*, wodurch sich dieselben als echte Bestandteile des Kelches zu erkennen geben." Much the same interpretation is given by Janchen¹ more recently in his discussion of the group. In *Lechea* the outer sepals are always much narrower but may be either longer or shorter than the inner. Usually the outer are greener and more leaf-like than the inner. In the narrow-leaved species with long exterior sepals, *L. san-sabeana* and *L. tenuifolia* for example, the small upper cauline leaves strikingly resemble these structures. The four species of *Lechea* which have calyces broadest near the base also have exterior sepals equaling to considerably exceeding the inner. The remaining species, except *L. patula*, *L. villosa* and *L. minor*, which possess relatively broad leaves in addition to long exterior sepals, have these from minute and hardly obvious to slightly shorter than the inner.

The CAPSULES are broadly ovoid and broadest toward the base in *Lechea tenuifolia* and its relatives (mentioned above), thus conforming to the shape of the calyx. The capsule is usually about equal to or slightly exceeded by the calyx but in three species, *L. divaricata*, *L. Deckertii* and *L. patula*, the capsule is much longer than the calyx. The first two have globose capsules; *L. patula* has them narrowly ovoid. A characteristic of several species is the fact that the three valves are somewhat or completely united. In the majority of species, the valves in maturity become separate to the base and hence are easily removed. The valves of *L. cernua* are united about to the middle. Those of *L. divaricata* and *L. Deckertii* are entirely grown together. The first two species have the wall of the capsule indurated; in the last named the wall is papery. The placentae and dissepiments, which in several species tend to become prominent, in *L. san-sabeana* become permanent structures in the capsule.

The SEEDS are of diverse form and number. For each species or variety they are fairly constant in shape, size and number per capsule. Depending on the number in the capsule, they are equilateral and dorsi-ventrally compressed if 2; irregularly ovoid if 1; of various shapes if 3; and 3-sided and tending to be equilateral, with two nearly flat subequal faces meeting in a sharp keel, when the number is 4 to 6. The shape of capsule characteristic of certain species determines to a lesser extent the form of the seeds. There are several species each having 1, 2, 3 and 4-6 seeds. The chief value of the seed-char-

¹ Engler & Prantl, Nat. Pflanzenfam. ii²¹. 295 (1925).

acters rests upon the fact that some species, which are otherwise difficult to separate, are easily distinguishable by their seed-differences. The seeds of several species are marked by certain peculiarities. *Lechea intermedia* has the mature seeds with a delicate covering which adheres in places resulting in a reticulate surface. Two other species, *L. divaricata* and *L. cernua*, have in maturity a non-reticulate membranaceous coat. *L. villosa* has very lustrous seeds possessing an almost transparent endosperm, thus allowing the embryo to be conspicuous. *L. tenuifolia* and *L. maritima* have light- to medium-brown dull (non-lustrous) seeds wherein the embryo may easily be noted. The remaining species have mostly dark-brown seeds with the embryo not apparent.

The FLOWERS of *Lechea* are of very minor value in classification. The flowering of *L. maritima* was considered by Leggett¹ so unusual that he specially mentioned the phenomenon. Britton² states "All the *Lecheas* which I have been able to examine in the field bloom very shyly and the whole plant appears to come into flower at the same time. This occurs in bright sunshine, the petals are fugacious and thus the flowers are of but little practical value in classification." I have studied the two common species, *L. intermedia* and *L. maritima*, intensively in the field during the summer and autumn but I have never seen either with fully expanded flowers. The scattered specimens in flower from the several herbaria represented in this study show that in some species the number of stamens (the floral organs most likely to yield diagnostic characters) in the flowers, even on the same plant, is very variable. *L. divaricata* has from 15 to 25 (perhaps more). *L. patula*, on the contrary, has an average of perhaps 6. *L. intermedia* has from 12 to 17. Other species are equally variable in the number of stamens and greatly overlap, indicating that this character has but little diagnostic value.

Kearney³ states that *Lechea maritima* may be "safely referred to" as being self-fertilized. If the amount of seeming hybridization between species is an indication of the nature of pollination, *L. maritima* must certainly be to a considerable extent cross-fertilized in one way or another. I have seen probable hybrids of *L. maritima* and *L. minor* from Nantucket and Chappaquiddick Islands collected by Bicknell. *L. villosa* rather frequently hybridizes with *L. maritima*.

¹ Bull. Torr. Bot. Cl. viii. 116 (1881).

² Bull. Torr. Bot. Cl. xxi. 246 (1894).

³ Contrib. U. S. Nat. Herb. (Bot. Dismal Swamp Region) v. 393 (1901).

Bicknell had a specimen from Chappaquiddick Island and Mrs. C. M. Carr has collected it in Sudbury, Massachusetts. In Concord, Massachusetts, during the autumn of 1934, I saw numerous intermediates between *L. villosa* and *L. maritima* growing with these species at the edge of a field. Besides these pronounced probable hybrids, I have seen dried specimens of similar character between *L. maritima* and *L. Leggettii* and between *L. maritima* and *L. intermedia*. They are frequently difficult to detect because of the close resemblance of the parents.

The genus *Lechea* is the most distinctive of the several genera in the *Cistaceae*. Hutchinson,¹ in his description of the family, states the characters (several of which are not found in *Lechea*): "Herbs or shrubs, often with *stellate* indumentum; leaves *opposite* or rarely *alternate*, simple; stipules present or *adnate* to the petiole; flowers ♀ *actinomorphic*, solitary to *cymose*, showy; sepals 3-5, *contorted*; petals 5 to 0, *contorted*, very soon falling off; stamens *numerous*, *hypogynous*; . . . style simple with 3-5 free or united stigmas; . . . seeds with endosperm and bent, coiled or folded embryo." Grosser² in his key to the *Cistaceae* correctly separates *Lechea* from the remainder of the family by attributing to it "Petala 3, persistentia. Aestivatio imbricata." The hairs are simple and falsely bicellular, not stellate (see discussion above). The leaves are alternate, without visible signs of stipules. The flowers are minute and about as conspicuous as those of a *Juncus*, though much more rarely seen. The sepals are 5 and are scarcely, or not at all, contorted. The petals are 3 and, as correctly stated by Grosser, imbricated and persistent. The stamens are in perhaps half of the species less than 8 or 10. The stigma is entirely sessile and strikingly plumose, thus differing from most members of the family, in which it is discoid or hemispherical. Of the three North American genera of the *Cistaceae*, *Lechea* is farthest removed from the more typical Old World genera.

What I believe to be the true relationship of most of the species follows in general the principal headings within the key. *Lechea san-sabeana*, distinct enough to warrant its being placed in the subgenus *Lechidium*, is most closely related to the narrow-leaved *L. tenuifolia* and *L. tripetala*. These, in turn, appear to be nearer the broad-leaved *L. villosa* and only remotely connected with the narrow-

¹ Fam. of Fl. Pl. Dicotyledons, 162, 163 (1926).

² Engler, Pflanzenr. iv¹⁹³, 10 (1903).

leaved southeastern *Lecheas*. The change from broad to narrow leaves is surely less fundamental than differences in reproductive structures. There is no evidence to show, however, that *L. tenuifolia* or any other narrow-leaved species ever tends to produce any but narrow leaves in whatever climate it grows. *L. villosa* var. *Schaffneri*, on the other hand, of semi-arid mountains of Mexico is distinguished from the broad-leaved var. *typica* of the more northern and less arid habitats by its much narrower leaves. In general it appears that a species like *L. villosa* (var. *typica*) with broad leaves, which have hairs both above and below, with basal leaves much like the cauline or perhaps lacking, with fairly prominent exterior sepals and several seeds (3 or more) represents a type from which most of the other species might have been derived. Beyond saying that the eastern species, *L. minor*, *L. racemulosa*, *L. patula*, *L. Leggettii* and *L. Torreyi* are definitely related, I hesitate to say more of relationship for want of definite facts.

GEOGRAPHICAL DISTRIBUTION

The *Cistaceae* as a family are found in North and South America, Europe, western Asia and northern Africa. There are but few species in Asia and South America. The strongest concentration of species is in the Iberian Peninsula and in that part of North America known as the Atlantic Coastal Plain, a range which may well indicate a considerable antiquity for the family as a whole. Fernald,¹ in speaking of areas having distinct and restricted floras, states "Again, can it be that the antiquity of the Iberian tableland, essentially undisturbed since the dawn of angiosperms, has nothing to do with the occurrence there of 800 endemics?" Many characteristic elements in the flora of the Coastal Plain have been shown to be ancient, because of their close relationships only with groups in remote parts of the world.

The facts that *Hudsonia* and *Lechea* are very distinct from the European genera of the family and that our third genus, although long referred to *Helianthemum*, is so different from the European and typical species of that genus that some recent authors, Britton,² Janchen³ and Small,⁴ regard it as generically distinct, demonstrate that the period when the family was connected in some manner between the two areas was remote.

¹ Quarterly Review of Biol. i. 233 (1926).

² Britton & Brown, Ill. Fl. ed. 2, ii. 539 (1913).

³ Engler & Prantl, Nat. Pflanzenfam. ii²¹. 305 (1925).

⁴ Small, Man. 878 (1933).

Confining our attentions to *Lechea*, we may note several interesting points in its distribution:

1. The occurrence in Florida, Cuba and Texas of five species having definitely localized range. Two, *Lechea cernua* and *L. divaricata*, are confined to central Florida; two others, *L. san-sabeana* and *L. mensalis*, are confined to Texas, the former to the eastern half of the state, the latter to a single station in the Chisos Mountains, where many local endemics occur; one, *L. cubensis*, is known only from a single locality in the western part of Cuba. Furthermore, two more species are in part or chiefly confined to Florida, *L. Torreyi* var. *typica*, which is restricted to that state, and *L. Deckertii* which, except for one station in southern Georgia, does not get out of its confines. In distribution, as in morphological structure which has been discussed for most of the species, the highly localized species may be considered to be in a stage of maturity or old age. It is a rather striking contradiction of the Age and Area hypothesis of Willis that the above named very specialized species, which are so distinct that in several instances their kinship in the genus is only to be guessed at, have strikingly restricted ranges.

2. The obvious sharing of range of several species between the Coastal Plain and the Appalachian Upland. Fernald¹ has discussed this relationship rather completely in his paper "*Specific Segregation and Identities in some Floras of eastern North America and the Old World.*" The conclusion seems to be tenable that the groups which are characteristic of the present youthful Coastal Plain but in major part are very old, persisted during the vicissitudes of the Tertiary on the very ancient area of the Appalachian Upland. *Lechea minor* and *L. racemulosa*, which are stable and very distinct species, are strikingly common on the Coastal Plain and likewise abundant in the mountains, *L. minor* in western North Carolina, eastern Tennessee and eastern Kentucky, *L. racemulosa* along the whole Appalachian axis from Pennsylvania south to northern Alabama and Georgia. One other species, *L. intermedia*, which is found on at least one of the Appalachian Mountains in Virginia (Elliott's Knob), is not abundant on the Coastal Plain. It is the dominant species of the genus, however, in most of glaciated eastern North America. This may indicate the source of some of our eastern species which are now characteristic of glaciated areas.

¹ RHODORA, xxxiii. 25-63 (1931).

3. The presence of several species in the region of Lake Michigan and Lake Erie. *Lechea minor* and *L. racemulosa*, in addition to their disrupted occurrences on the Coastal Plain and the Appalachian Upland, exhibit still another break in range by their presence about the Great Lakes. In this region, *L. racemulosa* is found only at the southern end of Lake Michigan in Indiana, while *L. minor* is found in Indiana, Michigan, Ohio and in southwestern Ontario. Except for the occurrence in Michigan the stations are all near Lake Michigan or Lake Erie. *L. Leggettii* var. *moniliformis*, the variety of *L. Leggettii* which is found on the Coastal Plain from Delaware north to Massachusetts, is also isolated in northwestern Indiana and northern Ohio. Otherwise it is absent from the interior of the continent. *L. villosa* var. *typica*, also of the Coastal Plain, is abundant in the states bordering the southern end of Lake Michigan as well as in Ohio and southern Ontario, but in these instances it is found only near the lakes or across northern Indiana and southern Michigan and is otherwise nearly absent. A comparison between the ranges of *L. tenuifolia* and of *L. villosa* var. *typica* may be of interest. In New England their ranges are somewhat similar except that *L. villosa* var. *typica* is much more a plant of the Coastal Plain. In the southern part of its range *L. tenuifolia* pushes farther into the interior. In the Mississippi Valley and in eastern Texas the ranges nearly coincide, except that, in the region of the Ohio River and in the area of the upper Mississippi, *L. tenuifolia* has proceeded farthest. Near the Great Lakes, however, *L. tenuifolia* is entirely wanting, whereas *L. villosa* var. *typica* is very abundant. The presence of *L. tenuifolia* in southern Maine and eastern Minnesota (north of the Driftless Area) attests to its hardiness, and its presence in much of southern New England proves its capacity for migration. There is no evidence to show that *L. villosa* var. *typica* is in any way more adaptable than is *L. tenuifolia*. The chief factor in the distributions appears to be this. One species, *L. villosa* var. *typica*, is a plant mostly of the Coastal Plain; *L. tenuifolia* is not. Plants of Coastal Plain range, for some reason as yet unsatisfactorily explained, are often abundant in the area at the southern end of Lake Michigan and to a lesser extent near the shores of Lake Erie.

I shall review some of the theories treating the origin of this interesting disruption of range. Peattie,¹ discussing the inland occurrence of Coastal Plain plants, states "In the flora of the Lake Michigan

¹ RHODORA, xxiv. 59 (1922).

area, at least, there are two general types of inland extension from the Coastal plain. The first type is the very discontinuous range. . . . About one third of all the Coastal plain species of this area show a roughly similar range with, perhaps, one additional station in New York State or on one of the other Great Lakes."

Later Peattie mentions *Euphorbia polygonifolia*: "This little plant of the sea strands [rather of dune-hollows] also occurs in a general way around the Great Lakes. . . . The majority of coastal plain species show a similar range." Peattie concludes that all of the species of the Coastal Plain which are found in the Great Lake area achieved their present limits in post-glacial time, their route of migration being along the Hudson-Mohawk Valley and the Lake Ontario Basin, thence along the margin of Lake Algonquin and through the Grand River Valley of what is now Michigan, finally to arrive at the southern end of Lake Michigan. Some lingered only in this very favorable spot. Others persisted in scattered favorable areas along the way.

It is quite possible that the species of *Lechea* migrated over such a route to arrive finally near Chicago. Their abundance on Long Island and in New Jersey shows this to have been possible. The utter lack of *L. minor*, however, along most of the postulated route of migration, and the fact that one-third of all the Coastal Plain species in northern Indiana have the extreme type of disruption revealed by *L. racemulosa*, which is absent from the entire hypothetical route, make it appear quite probable that considerable geologic change has taken place to bring about this disrupted range, more, in fact, than has occurred since the last of the several minor advances of the Wisconsin ice.

W. T. McLaughlin,¹ discussing the occurrence of Coastal Plain plants in northwestern Wisconsin and speaking of the recession of Wisconsin ice and the formation of Glacial Lake Duluth, writes, "It was, presumably, during this interval, while the ice was retreating northward and before the readvance, that the forest developed at Two Creeks, Manitowoc County." (The forest was mentioned earlier by him, l. c. p. 360.) If forests could develop "when the ice had retreated somewhat to the northward" and before a minor advance, is it not evident that the climate in the vicinity of the Driftless Area and Lake Michigan was, during much of the Wisconsin, suitable for vegetative development? McLaughlin² suggests that the Coastal

¹ Ecological Monog. ii. 360, 361 (1932).

² Ecological Monog. ii. 361 (1932).

Plain plants became established in the Chicago region during the time of this minor oscillation of ice. May it not be as accurate to say that this localized Coastal Plain flora, one-third with a broad disruption in range, is a relic-flora, the result of a pre-Wisconsin dispersal, as to attempt to account for it by a hypothetical path of migration in combination with a highly improbable late glacial or post-glacial destruction of all evidence of migration?

To explain the highly relict flora of Keweenaw County Fernald¹ states "The high bluffs of Keweenaw evidently were not denuded by Wisconsin ice and, consequently, they served as centers on which many species survived." Fassett² explains the existing relict flora confined to the Driftless Area as being "fairly interpreted on the basis of lack of glaciation in southwestern Wisconsin" but he considers it impossible that the Driftless Area should have housed any species of the Keweenaw Area. With the Wisconsin Glaciation becoming revealed as a series of separate phases of local origin, with distinct nunataks here and there which were never overrun, it seems to me that some part of the region at the southern end of Lake Michigan, with its highly localized flora of Coastal Plain species, may well have served as a haven throughout the Wisconsin.

I will here mention several other considerable disruptions of range. The station at Belleville near the northern shore of Lake Ontario, marks an extension of range of *Lechea stricta* from the southern end of Lake Michigan. This may mean that recent migration around the Great Lakes has been in part at least in an easterly direction, in this instance from the region in and about the Driftless Area and from the area about the southern end of Lake Michigan. It should be noted, however, that the region of Belleville has long been known for its remarkably isolated stations for western species, such, for instance, as *Myosurus Shortii* Raf., a typical prairie plant with a broad range from southwestern Indiana and western Kentucky and Tennessee to Texas and Manitoba, and *Collinsia parviflora* Lindl., with general cordilleran range but isolated eastward at remote points (Keweenaw Peninsula, Michigan, north shore of Lake Ontario, and a single mountain-slope in western Vermont). *Lechea stricta* may, consequently, prove to be a pre-Wisconsin relic at its easternmost station.

The occurrence of *Lechea Torreyi* var. *congesta* in British Honduras more than eight hundred miles from the nearest station near Miami,

¹ RHODORA, xxxvii. 216 (1935).

² RHODORA, xxxiii. 226-228 (1931).

Florida, is one which I will not attempt to explain nor can I account for the presence in northern Oklahoma of *L. tripetala*, which otherwise is confined to areas at high elevations in Mexico, unless it be in Oklahoma a relic from a very ancient dispersal. Its southernmost station, in Guatemala, is likewise on an ancient core, as ancient as the Ozark Upland.

MATERIAL EXAMINED

In the course of my work on this genus I have made extensive use of borrowed material and in addition I have visited the herbarium of the Philadelphia Academy of Sciences and that of the New York Botanical Garden. I have thereby been enabled to see representative material from the entire range of the genus as well as the principal type-material in American herbaria. The institutions from which I have seen specimens are listed below.

Amherst College (Amherst)	New England Botanical Club
Brooklyn Botanical Garden	New York Botanical Garden (NY)
(Brooklyn)	Philadelphia Academy of Sciences
Field Museum (Field)	(Phila)
Gray Herbarium	United States National Herbarium
Missouri Botanical Garden (Mo)	(US)

Following the name of each of the above institutions is appended the abbreviation which I have used in this work to indicate the location of cited material. That from the Gray Herbarium and the herbarium of the New England Botanical Club, I have not specially indicated, except in the case of types. When, as frequently happened, a collection is found in several herbaria, I have cited only the one from which the specimen was distributed, if this is known.

I wish to express my appreciation to those who very generously lent me their collections for study and I appreciate the warm hospitality extended to me at the institutions which I visited. I particularly thank Professor M. L. Fernald, who, throughout the work, has given me invaluable suggestions and guidance; Mr. C. A. Weatherby for his kind assistance in various ways; Dr. Lily M. Perry for many kindly services in putting the paper into final form; and Mr. E. C. Ogden for his aid in the preparation of the photographs. Although the maps are from a plate owned privately by Professor Fernald and intended for his own use, he has very generously permitted me the use of them in this particular study which was, of course, carried on under his supervision.

SYNOPTIC TREATMENT OF GENUS

LECHEA L.¹ Perennials, suffruticose to herbaceous, subprocumbent to erect, mostly strongly branched: leaves alternate to falsely verticillate, ovate to narrowly lanceolate, or even subulate: flowers small (2–4 mm. broad), numerous; sepals 5, in two distinct series, the 2 outer narrowly lanceolate to narrowly linear or subulate, frequently inconspicuous, the 3 inner imbricated in the bud, ovate to obovate, from shorter than to greatly exceeding the outer; petals 3, dark red, mostly shorter than the sepals, imbricated, plane in the bud, after flowering very quickly withering, marcescent; stamens 3–25 (mostly 5 or 6–15): ovary short-stipitate: style very short or lacking: stigmas 3, dark-red, fimbriate-plumose: placentae 3, broad and valve-like, each bearing (primitively) a pair of erect subsessile ovules, one on each side of the posterior face:² capsule narrowly ovoid or obovoid to depressed-globose, with 3 valves: embryo slender, nearly straight to considerably curved in the hard endosperm.—*Sp. Pl.* 90 (1753) and *Gen. Pl.* ed. 5, no. 102 (1754).

The sections *Lechidium* and *Eulechea* are retained in this study and are separable by the characters under the two primary headings in the key.

Sect. I. **LECHIDIUM** (Spach) Torr. & Gray, *Fl. N. Am.* i. 154 (1838); Robinson in Gray, *Syn. Fl. N. Am.* i¹. 194 (1895); Grosser in Engler, *Pflanzenr.* iv¹⁹³. 139 (1903). *Lechidium* Spach in Hook. *Comp. Bot. Mag.* ii. 286, 287 (1837) and *Hist. Nat. Veg. Phan.* vi. 112 (1838).

Sect. II. **EULECHEA** Robinson in Gray, *Syn. Fl. N. Am.* i¹. 192 (1895); Grosser in Engler, *Pflanzenr.* iv¹⁹³. 134 (1903).

KEY TO SPECIES

- a. Placentae crustaceous, uniting with the dissepiments to form within the mature capsule, opposite the valves, 3 distinct and prominent yellow structures, each with two cavities open at the back, serving to press the two seeds against the valve of the capsule: pedicels more than 3 mm. long: calyx 2.5 mm. broad or more. Sect. **LECHIDIUM** (Spach) T. & G. 1. *L. san-sabeana*.
- a. Placentae and dissepiments within the mature capsule disintegrating or adhering to the seed (fragile, but prominent at maturity in *L. tripetala*): pedicels less than 3 mm. long: calyx less than 2.5 mm. broad, except occasionally in *L. tripetala*. Sect. **EULECHEA** Robinson. . . . b.
- b. Exterior sepals equaling or exceeding the interior sepals c.

¹ Linnaeus in *Gen. Pl.* ed. 5, no. 102 (1754), attributed the authorship of the genus to Kalm and in *Amoen. Acad.* iii. 10 (1756) he explained that the genus was dedicated to Professor J. Leche of Abo.

² Spach in Hooker, *Comp. Bot. Mag.* ii. 288 (1837), writes of the position of the ovules in relation to the placentae, "all the other *Cistaceae* having their ovules attached on the anterior face, or on the margins of the placentas."

- c. Basal leaves elliptic-ovate to broadly lanceolate: cauline leaves narrowly lanceolate to elliptic-ovate....d.
- d. Culine leaves broadly lanceolate to elliptic: pubescence strongly spreading: capsule not exceeding the calyx....e.
- e. Calyx depressed-globose, broadest toward the base, except in var. *macrotheca*; interior sepals strongly keeled, deeply concave; exterior sepals about equaling the interior ones: seeds inequilateral, strongly convex dorsally, light-brown, lustrous, the embryo clearly visible: capsule about as broad as long: fruits glomerate-clustered, except in var. *macrotheca*.....2. *L. villosa*.
- e. Calyx pyriform, broadest above the middle; inner sepals slightly keeled; outer sepals exceeding the inner: seeds equilateral, elliptic-oblong, dorsiventrally compressed, dark-brown, the embryo not clearly apparent: fruits loosely clustered to closely racemose.....3. *L. minor*.
- d. Culine leaves narrowly lance-oblong: calyx very short, strongly pyriform: capsule considerably exceeding the calyx.....4. *L. patula*.
- c. Basal leaves, if present, narrowly linear: cauline leaves always narrowly linear: fruiting calyx broadest below the middle or toward the base....f.
- f. Calyx more than 2 mm. broad; sepals strongly keeled: seeds 4-6.....5. *L. tripetala*.
- f. Calyx 2 mm. or less broad; sepals slightly or hardly at all keeled: seeds 1-4....g.
- g. Calyx depressed-globose; outer sepals mostly exceeding the inner: capsule depressed-globose: seeds 2-4.....6. *L. tenuifolia*.
- g. Calyx ovoid, considerably longer than broad; outer sepals about equaling the inner: capsule ovoid; seed 1.....7. *L. mensalis*.
- b. Exterior sepals shorter than the interior ones....h.
- h. Capsule greatly exceeding the calyx, its valves coalesced....i.
- i. Culine leaves linear-oblong, abruptly acute or obtuse: calyx nearly glabrous, strongly spreading from base of capsule and not at all enclosing it: wall of capsule papery.....8. *L. Deckertii*.
- i. Culine leaves lance-elliptic, sharply acute; calyx subappressed-pilose, firmly enclosing the base of capsule: wall of capsule indurated.....9. *L. divaricata*.
- h. Capsule exceeded by to but slightly exceeding the calyx....j.
- j. Basal leaves lance-elliptic to broadly elliptic-ovate, less than 3 times as long as broad: calyces strongly pyriform: pedicels exceeding calyx: seeds 1-2....k.
- k. Basal leaves bright-green, thin, lance-elliptic to lance-ovate, spreading-pilose beneath on midrib and margin, glabrous above: cauline leaves mostly narrowly lanceolate: seeds 1-2 (mostly 2), dorsiventrally compressed, nearly or quite equilateral: fruits scattered, racemose.....10. *L. racemulosa*.
- k. Basal leaves grayish-green, thick, broadly elliptic-ovate, densely pilose to tomentose below, strongly pilose above: cauline leaves broadly lance-ellip-

- tic to ovate: capsule-wall strongly indurated; valves coalesced below: seed 1, irregularly ovoid: fruits loosely clustered, the pedicels spreading to reflexed.....11. *L. cernua*.
- j. Basal leaves, when present, elliptic-lanceolate to narrowly lanceolate or linear, more than 3 times as long as broad: cauline leaves narrowly lanceolate or oblanceolate to narrowly linear....l.
- l. Basal shoots lacking or with narrowly linear leaves: cauline leaves narrowly linear....m.
- m. Exterior sepals nearly equaling the interior ones: capsule about equaling the calyx: sepals closely pilose: plant low, less than 20 cm. high.....12. *L. cubensis*.
- m. Exterior sepals much shorter than the interior ones: calyx exceeding and concealing the capsule: sepals densely somewhat spreading-pilose: plants more than 20 cm. high.....13. *L. Torreyi*.
- l. Basal shoots present at maturity: basal leaves elliptic-lanceolate to narrowly lanceolate or oblanceolate....n.
- n. Basal leaves thick, dull-green, strongly subappressed- to spreading-pilose beneath on midrib and margin and somewhat on the lower face: panicle mostly branched from well below the middle, frequently subpyramidal, the branches gradually reduced above except in var. *subcylindrica*.....14. *L. maritima*.
- n. Basal leaves thin, bright-green above, subappressed- to spreading-pilose beneath on midrib and margin, elsewhere glabrous: panicle mostly branched from above the middle....o.
- o. Seeds 2-4, dorsiventrally compressed (2-sided) or obscurely 3-sided, nearly equilateral, elliptic-oblong or enlarged at base, smooth at maturity....p.
- p. Stems and branches strongly pilose: calyx strongly pilose with somewhat spreading hairs: plant dull-green: branches crowded, strongly ascending to suberect: seeds 3 or 4.....15. *L. stricta*.
- p. Stems and branches sparingly pilose: calyx sparingly pilose with appressed to somewhat spreading hairs: plant bright green: branches ascending to broadly spreading: seeds mostly 2 or 3.....16. *L. Leggettii*.
- o. Seeds 4-6 (5 or 6 in larger capsules) except in var. *depauperata*, inequilateral and prominently 3-sided, dorsally convex with 2 subequal lateral faces meeting in a straight ventral keel, at maturity with a white reticulate membranaceous covering.....17. *L. intermedia*.

1. *LECHEA san-sabeana* (Buckley), comb. nov. Caudex simple and ascending to strongly branched and subprocumbent: basal shoots numerous, subappressed-pilose on the axis; leaves linear, abruptly pointed, glabrous above, subappressed-pilose beneath: fruiting stems several to many, 15-35 cm. tall, sparsely foliose from near the base,

at first densely pilose, at length becoming sparingly appressed-pilose: cauline leaves linear, 6–18 mm. long, 0.6–1.3 mm. broad, on the branches often smaller, glabrous on the upper surface, at first densely pilose, at length prominently subappressed-pilose beneath mainly on the midrib and margin: panicle loosely spreading-branched from below the middle; secondary branches racemose, 5–15 cm. long, simple or once branched, bearing buds, flowers and ripe fruit often simultaneously: petals dark-red, often exceeding the sepals: stamens 7–12 or more: fruits secund, spreading at right angles to the axes, loosely distributed to somewhat remote, particularly toward the tips of the branches: pedicels slender, 3–5 mm. long, at length sparsely subappressed-pilose: calyx in fruit depressed-triangular-ovoid, 3 mm. broad, slightly more than 2 mm. long; calyx-lobes broadly ovate, dark-red on the inner surface, hood-shaped, strongly keeled dorsally, deeply concave ventrally, at first densely spreading-pilose, later coarsely subappressed-pilose, strongly so on the keel and glabrous on the broad scarious margins: bracts narrowly linear, green, about equaling sepals: capsule depressed-globose, 1.2–2.2 mm. long, 2.2–2.4 mm. broad; valves deeply ovate, spreading slightly in maturity; dissepiments and placentae crustaceous, pale-yellow, firm, persistent, attached to the base of the capsule, dividing above into 3 separate seed-bearing portions, confronting the valves: seeds normally 6, 2 of them partially enclosed by each dissepiment, light-brown; embryo slightly visible through the endosperm, ventrally concave, occasionally somewhat inequilaterally bifacial, narrowed at base and abruptly narrowed to the acute apex, usually somewhat shriveled, 1–1.1 mm. long.—*Linum San-Sabeanum* Buckley in Proc. Acad. Nat. Sci. Phila. for 1861: 450 (1862). *Lechidium Drummondii* Spach in Hook. Comp. Bot. Mag. ii. 287 (1837) and in Hist. Nat. Veg. Phan. vi. 112 (1838). *Lechea Drummondii* (Spach) Torr. & Gray, Fl. N. Am. i. 154 (1838); Eaton & Wright, N. Am. Bot. 294 (1840); Walpers, Repert. i. 213 (1842); Gray, Gen. i. 206, t. 89 (1849); Coulter, Bot. W. Texas in Contrib. U. S. Nat. Herb. ii. 24 (1891); Britton in Bull. Torr. Bot. Cl. xxi. 252 (1894); Robinson in Gray, Syn. Fl. N. Am. i¹. 194 (1895); Chapman, Fl. So. U. S. ed. 3: 37 (1897); Small, Fl. 799 (1903); Grosser in Engler, Pflanzenr. iv¹⁹³. 139, fig. 22, N–V (1903).—Coastal Plain of Texas north to Dallas and Fort Worth and westward nearly to the Edwards Plateau. TEXAS: Enchanted Rock, Llano Co., June 1, 1930, *Tharp & Whitehouse*, no. 86,950a; sandy open ground near Moore, Frio Co., May 9, 1928, *E. J. Palmer*, no. 33,854; dry soil near Huntsville, June 2, 1914, *N. S. Young*; de Matamoros a Goliad, April, 1834, *Berlandier*, nos. 2458, 1028; in sylvis prope el Rio de Medina, July, 1829, *Berlandier*, no. 2041 = 631; S. Felipe de Austin, *T. Drummond*, no. 17 (Hooker misit January, 1835); dry banks, Hempstead, *E. Hall*, no. 31; sandy forests, Upper Cross Timbers, *Reverchon* (Curtiss, N. Am. Pl. no. 232); dry sterile places, Galveston, *Lindheimer*, no. 16; sands, Dallas, *Reverchon*, no. 52 (US); Sabine River, *Leaven-*

worth (NY); dry open ground, Bryan, Brazos Co., *E. J. Palmer*, no. 7818 (NY); San Saba Co., *Buckley* (TYPE in Herb. Phila. Acad. Sci.); San Saba Co., 1890, *Nealley* (Field); Cuero, *Bray*, no. 133 (US); Bastrop, 1928, *H. Duval* (US); College Station, June 10, 1891, *L. H. Dewey* (US); sandy soil, 20 miles south of San Antonio, *E. D. Schulz*, no. 456 (US); in sandy open oak woods at Lake Worth, Tarrant Co., *Ruth*, no. 888 (US); in sandy pasture land, Tarrant Co., *Ruth*, no. 399 (Field); Indianola, 1869, *Ravenel*, (US); Navarro Co., *Joor*, no. 83 (US); on dry flats, near Pass Izard, 1889, *F. W. Thuran* (US); Gillespie Co., *Seguaro*, no. 620 (Mo); sandy woods, Granbury, *Reverchon*, no. 52 (Mo); Aransas Pass, San Patricio Co., *Orcutt*, no. 5964 (Mo). PLATE 488, FIGS 1, 2 and 3; MAP 1.

Spach¹ divided the genus into two genera, *Lechea* and *Lechidium*. The latter was set apart on certain structural peculiarities of the species *Lechidium Drummondii*, which was described in the same article. At the same time Spach described *Lechea Drummondii* in the other genus. In brief, the description of the latter is as follows: exterior sepals longer than the interior; the capsule slightly exceeding the calyx; leaves of radical shoots ovate or elliptic, ciliate beneath; pedicels short; seeds 3, reddish-brown, smooth and shining and pelucid enough to allow the embryo to be seen through it. These characters clearly diagnose *L. villosa* Ell. Thus the name *L. Drummondii* Spach is a later synonym of *L. villosa* Ell. and may not be used, as a specific name, again in the genus.

The diagnostic characters used by Spach for the new genus *Lechidium* concern the fruit and are virtually the same which have, since his time, been employed by monographers to set apart *Lechidium* as a subgenus or section. My feeling is that it is certainly no more than a section of *Lechea*; in all superficial respects *Lechidium Drummondii* closely simulates *L. tenuifolia* and *L. tripetala*, and even in the placentae and dissepiments there is most certainly an approach to those of the last named species. The distinctive peculiarities, the extreme length of the pedicel, the very large fruits and the definite and persistent placentae and dissepiments are definite enough to allow me to follow Gray,² Robinson³ and Grosser⁴ in conserving the section. A new name, therefore, is needed for the plant now passing as *L. Drummondii*. The only other name ever given to it was *Linum San-Sabanum* Buckley. Gray had seen Buckley's collection and found it to

¹ Hook. Comp. Bot. Mag. ii. 284-289 (1837).

² Gen. i. 206 (1848).

³ Syn. Fl. N. Am. i¹. 194 (1895).

⁴ Engler, Pflanzenr. iv¹⁹³. 139 (1903).

be identical with the plant which he called *Lechea Drummondii*. I also have seen the type and agree with his identification; but, according to the present rules of Nomenclature, the name must be *Lechea san-sabeana*.

2. *L. VILLOSA* Ell. Caudex low, simple or slightly to strongly sub-erect-branched: resting basal shoots numerous or lacking, 4–10 cm. long, branching or simple; the axis densely villous: basal leaves large (0.8–1.5 cm. long), crowded, mostly whorled, bright- to dark-green, broadly elliptic-ovate, mucronate-pointed or narrower and with a less distinct mucro when mature, glabrous above, villous beneath on midrib and margin: axes of developing shoots strongly villous to subappressed- or spreading-pilose; their leaves sparsely to densely villous over the entire lower surface or at least on midrib and margin and often slightly subappressed- to spreading-pilose above, or strongly subappressed-pilose over the entire lower and upper surfaces: fruiting stems one to several, 15–90 cm. high, erect to spreading, closely subcylindric-paniculate to broadly spreading-branched; the axes sparingly to densely villous or spreading-pilose either their entire length or in the panicle; the branches short, consisting essentially of fruit-clusters, or long and leafy, suberect to spreading: cauline leaves spreading to appressed, bright- to dull-green, distinctly petiolate to sessile, oblanceolate or lance-elliptic and mucronate to lanceolate or oblanceolate and acute or pointed, sparsely but conspicuously villous on the lower surface, scatteringly spreading-pilose to glabrous on the upper surface or densely spreading-pilose on both surfaces: fruit deep purplish- to greenish-brown, strongly glomerate to diffuse-glomerate or scattered-secund: pedicels 0.8–1.5 mm. long, sparsely spreading-pilose: calyx 1.4–2 mm. long, with a short yellowish-brown obconic base, about as broad as long, broadest near the base or spreading above and slightly pyriform; inner sepals from one-half to two-thirds as broad as long, with broad scarious margins, scatteringly pilose on the conspicuous keel; outer sepals narrowly lanceolate to linear and nearly or quite equaling the inner ones of broadly lanceolate (1.9–2.2 mm. long, 0.4–0.7 mm. broad) and equaling or exceeding the inner: capsules lustrous, depressed-globose, about equaling calyx; valves ovate, obtuse, broadly keeled, when mature separating to the base: seeds with a clear (transparent) endosperm with the embryo distinctly visible, decidedly inequilateral, 2-sided or obscurely 3-sided, greatly enlarged at base, abruptly acute at apex; if 3 or 4 bright-brown to clear-yellow, mostly lustrous, strongly convex dorsally, concave ventrally or flattened, 0.9–1 mm. long, 0.5–0.6 mm. broad; if 2 light-brown to pale-yellow, lustrous to dull, convex dorsally, concave ventrally, 1–1.2 mm. long, 0.6–0.7 mm. broad.

- a. Fruit small: calyx less than 2 mm. long, broadest near the base; the exterior sepals linear, slightly shorter than to equaling the inner: seeds 3–4, 1 mm. or less long.

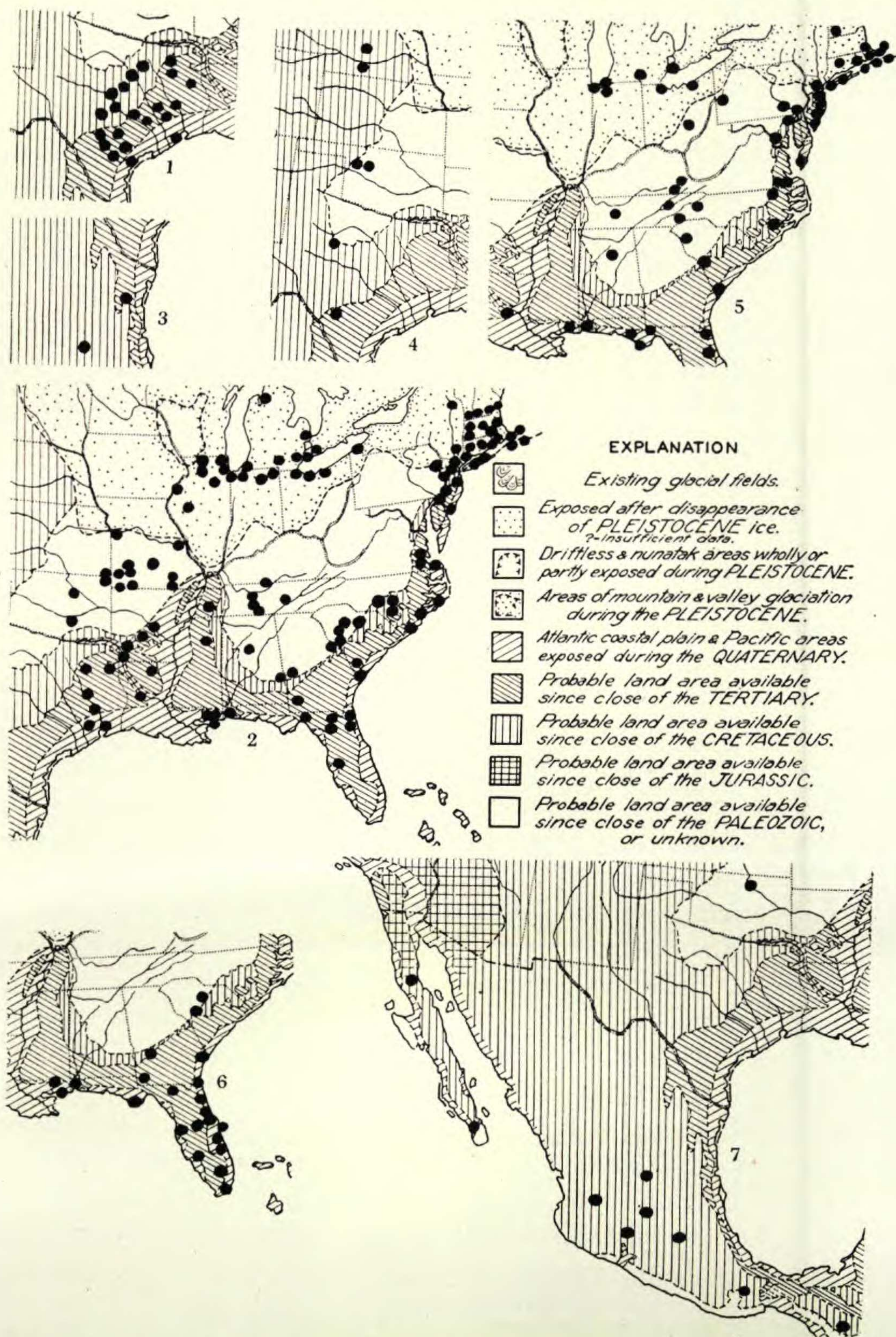
- Plant bright-green: fruiting stems few, erect, tall: basal resting shoots conspicuous: pubescence on most of plant distinctly villous: cauline leaves spreading, sparingly spreading-pilose to villous beneath, glabrous to sparingly spreading-pilose on the upper surface. Var. *typica*.
- Plant dull- or grayish-green: fruiting stems several, spreading, low: basal resting shoots lacking: cauline leaves subappressed: pubescence mostly densely spreading-pilose, equally on the upper and the lower surfaces. Var. *Schaffneri*.
- a. Fruit comparatively large: calyx 2 mm. or more long, pyriform, broadest at the middle; the exterior sepals large, lanceolate, equaling to slightly exceeding the inner: seeds 2, more than 1 mm. long. Var. *macrotheca*.

Var. **typica**. Caudex low, simple: resting basal shoots numerous, bright-green, frequently branching, large, 5–10 cm. long, developing in September except in southern United States; the axes densely villous: their leaves short-petioled, crowded, mostly in whorls, bright green, broadly elliptic-ovate, the lower ones mucronate, glabrous on the upper surface, conspicuously villous beneath on midrib and margin: fruiting stems few, erect; their axes brownish-purple, conspicuously villous: panicles closely subcylindric to broadly pyramidal; primary branches short (1–3 cm.) and consisting essentially of fruiting clusters, or up to 12 or 15 cm. long and erect or spreading and leafy: cauline leaves bright-green, spreading, 1–3 cm. long, with a distinct petiole 1–3 mm. long, oblanceolate to lance-elliptic, mucronate, conspicuously but sparsely villous on the lower surface, sparsely spreading-pilose above: fruits glomerate at ends of the primary or, in greatly branching plants, at the tips of the secondary branches: pedicels 1–1.5 mm. long, sparsely spreading-pilose; calyx depressed-globose, dark brown, broadest below the middle, meeting the pedicel in a short obconic yellowish-brown base; interior sepals broadly lance-elliptic, subacute, 1.3–1.6 mm. long, deeply concave, prominently keeled and with broad scarious margins, conspicuously pilose only on the keel; exterior sepals narrowly lanceolate to linear, nearly or quite equaling the inner: capsule depressed-globose, about equaling the calyx, 1.4–1.7 mm. long: seeds mostly 3, bright-brown to clear-yellow, lustrous, strongly convex dorsally, concave or flattened ventrally, 0.9–1 mm. long, 0.5–0.6 mm. broad.—*L. villosa* Ell. Sk. Bot. S. Car. & Ga. i. 184 (1816); Dunal in DC. Prod. i. 285 (1824); Beck, Bot. N. & Mid. St. i. 36 (1833); Darlington, Fl. Cestrica, 96 (1837); Dietr. Syn. Pl. i. 415 (1839); Britton in Bull. Torr. Bot. Cl. xxi. 248 (1894); Britton in Britton & Brown, Ill. Fl. ed. 1, ii. 442, fig. 2477 (1897); Britton, Man. 632 (1901); Small, Fl. 798 (1903); Robinson & Fernald in Gray's Man. ed. 7: 578 (1908); Stone, Pl. So. N. J. 563, pl. 83, fig. 1 (1911); N. Taylor, Fl. Vic. N. Y. 448 (1915); Small, Man. 882 (1933). *L. major* sensu Michx. Fl. Bor.-Am. i. 76 (1803); sensu Ait. f. Hort. Kew. ii¹. 185 (1810); sensu Bigelow, Fl. Bost. 28 (1814); sensu Pursh, Fl. Am. Sept. i. 90 (1814); sensu Eaton, Man. ed. 2: 296 (1818); sensu Barton, Fl. Phil. 75 (1818); sensu Torrey, Fl. i. 60 (1824); sensu Eaton &

Wright, N. Am. Bot. 294 (1830); sensu Torrey & Gray, Fl. N. Am. i. 153 (1838); sensu Darby, Man. Bot. So. St. ii. 33 (1841); sensu Torrey, Fl. N. Y. 78 (1843); sensu Gray, Man. 49 (1848); sensu Chapman, Fl. So. U. S. 36 (1860) and subsequent editions including ed. 3; sensu Leggett in Bull. Torr. Bot. Cl. vi. 251 (1878); sensu Robinson in Gray, Syn. Fl. N. Am. i¹. 192 (1895); not *L. minor* sensu Smith in Rees's Cycl. 20 (1819). *L. Drummondii* Spach in Hook. Comp. Bot. Mag. ii. 284 (1837) and in Hist. Nat. Veg. Phan. vi. 110 (1838), including in greater part the *L. major* var. *villosa* Grosser in Engler, Pflanzenr. iv¹⁹³. 136 (1903). *L. mucronata* Raf. New Fl. N. Am. i. 193 (1836); sensu House, Annot. List Ferns & Fl. Pl. N. Y. 497 (1924); not *L. mucronata* of Raf. Précis des Découvertes, 37 (1814); *L. major* var. *α. villosa* Grosser in Engler, Pflanzenr. iv¹⁹³. 136 (1903).—Generally abundant in sandy or gravelly soils in fields and open woods or on open slopes, southern New Hampshire to Florida, west to Michigan, Oklahoma and eastern Texas; absent from the Appalachian Mountains. Var. *typica* is so definite a plant that it is unnecessary to cite the numerous specimens examined. PLATE 488, FIGS. 4, 5, and 6; MAP 2.

Var. **Schaffneri**, var. nov. Caudex multiceps ramosus ramis gracilibus sine ramis basilaribus; caules fructiferi plures suberecti 15–40 cm. alti dense patuleque pilosi vel villosi; folia subadpressa lanceolata vel oblanceolata anguste acuta vel acuminata opaca viridia supra et subtus dense patuleque pilosa 8–15 mm. longa 2.5–5 mm. lata; panícula anguste subpyramidata, rami breves valde ascendentes; flores in glomerulos laxos vel racemos densos dispositis.—Mountains of central Mexico. I have seen the following specimens. TAMAULIPAS: La Vegonia, vicinity of San Jose, alt. 3000 ft., *H. H. Bartlett*, no. 10,020 (US). SAN LUIS POTOSI: in montibus San Rafael, 1876, *Schaffner*, no. 602 (TYPE in Gray Herb.), 1879, *Schaffner*, no. 471 (US). MAP 3.

Var. **macrotheca**, var. nov. Caudex plerumque multiceps ramis brevibus; rami basilares 1.5–3 cm. longi eorum folia late lanceolata patule pilosa vel villosa; folia caulina lanceolata vel oblanceolata acuta 1–3 cm. longa 2–7 mm. lata supra et subtus pilosa pilis patulis vel subadpressis; flores laxè glomerati vel dense secundo-racemosi; pedicelli 1 mm. aut minus longi; calyx late pyriformis pallide brunneus supra basin valde dilatatus 1.9–2.1 mm. longus 1.9–2 mm. latus; sepala interiora lanceolato-elliptica acuta 2-plo longiora quam lata; sepala exteriora lanceolata 1.9–2.2 mm. longa 0.4–0.7 mm. lata interiora aequantia vel paullo superantia saepe lucida 1–1.2 mm. longa 0.5–0.7 mm. lata inaequilateralia latere dorsali convexa ventrali concava vel rarius convexa et subangulata.—Sand-hills, prairies and sandy woods, west-central Nebraska to southern Texas. The following specimens have been seen. NEBRASKA: sand-hills, Loup Fork, August 26, 1853–1854, *F. V. Hayden* (Mo); prairies and sand-hills of Kearney Co., *Rydberg*, no. 6632 (NY); Minden, July, 1892, *Hapeman* (NY); Minden, August, 1893, *Hapeman* (US). OKLAHOMA: in open



MAP 1, range of *LECHEA SAN-SABEANA*; 2, of *L. VILLOSA*, var. *TYPICA*; 3, of *L. VILLOSA*, var. *SCHAFFNERI*; 4, of *L. VILLOSA*, var. *MACROTHECA*; 5, of *L. MINOR*; 6, of *L. PATULA*; 7, of *L. TRIPETALA*.

sandy woods, near Cleo, Major Co., *G. W. Stevens*, no. 1728 (TYPE in Gray Herb.); Woodward Co., July 14, 1900, *Paul J. White* (Mo). TEXAS: sandy open ground, Fort Chadburn, Coke Co., *E. J. Palmer*, no. 12,453. PLATE 488, FIGS. 7 and 8; MAP 4.

H. D. House¹ has taken up the name *Lechea mucronata* of Rafinesque for our *L. villosa*. The former name antedates by two years the latter which, according to Barnhart,² was published in 1816. Grosser³ in his monographic treatment cited *L. mucronata* as a synonym of *L. major*, our *L. villosa*. The only possible diagnostic features of Rafinesque's description are embodied in the following⁴ "feuilles oblongues-cuneiformes mucronées, fleurs en grappe composée." So many species have the "fleurs en grappe composée" that this portion of Rafinesque's diagnosis might apply to most members of the genus. The other phrase "feuilles oblongues-cuneiformes mucronées," applies equally well to *L. minor* and to *L. villosa* as do the brief diagnostic phrases for some others of Rafinesque's proposed species. Without type-material to show exactly what the author had, it is futile to guess; and only confusion can result by overthrowing a well characterized and clearly typified name, such as *L. villosa*, by taking up for it a vague name which must always be open to doubt. Elliott⁵ indicated definitely what he had. Following a brief Latin description is a discussion, part of which I quote, "the radical and young stem branches covered with white hairs . . . branches 2-4 ins. long that trail on the ground . . . seed 1 in each cell, oblong, angled at one side, acute at each end. . . This plant if kept from running to seed would probably form a very neat edging for the beds of a flower garden." Dr. Svenson of the Brooklyn Botanic Garden told me in 1933 that there was an occasional demand there for seed of *L. villosa* for horticultural purposes. Horticulturally, any other species would, I believe, receive no more than passing attention and that only by seekers of the curious. Elliott's *L. villosa* is supported further by a type specimen, which Britton,⁶ p. 248, states is in the Elliott Herbarium. In 1836 Rafinesque again used the name *L. mucronata*, accompanying it this time with a more complete but weak description and with a statement that it was the same as Elliott's *L. villosa*. It is

¹ Annot. List Ferns & Fl. Pl. N. Y. 497 (1924).

² Bull. Torr. Bot. Cl. xxviii. 680-688 (1901).

³ Engler, Pflanzenr. iv¹⁹³. 136 (1903).

⁴ Précis des Découvertes et Trav. 37 (1814).

⁵ Sk. Bot. S. Car. & Ga. i. 184 (1816).

⁶ Bull. Torr. Bot. Cl. xxi. 247, 248 (1894).

enough to say that there will always be confusion in our minds regarding Rafinesque's *Lecheas*. The name *L. major* has been used until recently for our *L. villosa*, despite the fact that Elliott, l. c., accurately states in the synonymy of *L. villosa* "*L. major* not of Linn. which was an *Helianthemum*." Smith¹ also realized this important fact but, from the mixture of species which Linnaeus had in his herbarium representing *L. minor*, Smith chose a specimen of *L. villosa* as typical. That he doubted the advisability of the choice is manifest by the following quotation, "Amid all this uncertainty we would rather strike out *L. major* and give a new name perhaps *heterophylla* to our *minor*." Britton² has given the currently accepted interpretation of the Linnean type of *Lechea*. The specimens of *L. villosa* which are represented in the Linnean Herbarium are not referable in any way to the description in the *Species Plantarum*. The specimen which is directly referable to the description is the very distinct species which we now call *L. minor* (see discussion of that species).

Much of the southern material, including the Virginia and Florida specimens, differs in habit from most of the northern plants. Close checking revealed no fundamental differences. Seeds, capsules and calyces, as well as leaves, were alike in both. The northern plant, limited by the growing season, produces fruit in dense clusters on short branches, which are borne in a compact spire-like inflorescence. Along the coast from Virginia to Florida and Texas the vegetative development is frequently more extensive. In Florida the fruiting stems may become perennial near their bases, sending out lateral branches at intervals along the axis, resulting, after a time, in a broadly branched plant. The usual effect of the longer growing season on *L. villosa*, as on other species, is to increase the vegetative growth, which may serve to initiate structural differentiation in some members of the genus. The increased growing season has not, however, brought about any differences in *L. villosa* greater than those earlier described. I do not consider that these differences deserve formal rank, because of the great variation in habit of the species throughout its range. They seem, however, to permit of an explanation and only for that reason do I mention them here.

Lechea villosa var. *Schaffneri* differs somewhat strikingly from var. *typica* by its shrubby base, lack of basal shoots, mostly low tufted

¹ Rees's Cycl. 20 (1819).

² Bull. Torr. Bot. Cl. xxi. 247, 248 (1894).

habit and dull-green color, which may be accounted for, probably, by the very strong development of pubescence on the upper surfaces of the lanceolate leaves. These are considerably narrower than those of var. *typica*. As in several other tropical and subtropical species of the genus, basal resting shoots are lacking. The new shoots develop immediately from the caudex, near the base, or above from persisting stems, and at first have slightly broader leaves than in the mature condition. In such capsules as were mature enough for study there were mostly four seeds. Plants of *L. villosa* var. *typica* in a similar stage of development have mostly three seeds in each capsule. Not enough specimens, however, of the Mexican variety have been seen to make a safe generalization. The fruits in other respects closely resemble those of typical *L. villosa*, except that they are produced in fewer clusters of less densely aggregated individuals.

It is difficult to say whether there were two distinct collections of this plant by Schaffner. In the Gray Herbarium is a sheet labelled "in montibus San Rafael, 1876, no. 602" and in the United States National Herbarium is another labelled "San Luis Potosi: 1879, Dr. J. G. Schaffner, no. 471." The single sheet of Schaffner's collection in the New York Botanical Garden is given both of these numbers. Grosser¹ cites the Schaffner material as two separate numbers. In a discussion of Schaffner's work, Hemsley² says, "From time to time further contributions were received from him, the last in 1881, through Dr. Asa Gray, from the neighborhood of San Luis Potosi where he resided some time before his death . . . unfortunately each collection was separately numbered." It is difficult then to say whether we have one or more than one collection of *L. villosa* var. *Schaffneri* by Schaffner, especially since the specimens are of a similar age and appearance.

Lechea villosa var. *macrotheca* differs from the wide-ranging var. *typica* and from var. *Schaffneri* in its short basal shoots which bear lanceolate leaves, its less striking villosity throughout, the paler-brown, much larger and more scattered fruit, the narrower lanceolate leaves which are usually strikingly pilose above, the two large seeds contrasted with the 3 (4) of var. *typica* and, perhaps most striking of all, in the extremely large exterior sepals (the largest in the genus).

3. *L. MINOR* L. Caudex simple or with a few short ascending branches: basal shoots in September and October slender, mostly not

¹ Engler, *Pflanzenr.* iv¹⁹³. 136 (1903).

² *Biol. Centr. Am.* iv. 134, 135 (1886-1888).

exceeding 5 cm. in length, subappressed-pilose; their leaves mostly verticillate, frequently in whorls of 3, ovate to elliptic-ovate, mucronate, 4–7 mm. long, about half as broad, spreading-pilose to subvilous beneath on midrib and margin, frequently sparingly scattered-pilose above: fruiting stems 1 to several, slender, leafy, 20–50 cm. high, with numerous short ascending to appressed primary branches or with long ascending primary branches and short ascending secondary ones: panicle compact, leafy, mostly narrowly subcylindric (occasionally much broader, to subglobose); the axis with fine subappressed to spreading incurved hairs: cauline leaves bright-green, short-petioled; those below the panicle frequently in whorls of 3 or 4, elliptic-ovate to lanceolate, mucronate, finely, often inconspicuously, spreading-pilose over the entire surface above and beneath; those in the panicle mostly scattered, lance-oblong to narrowly lanceolate or oblanceolate, slightly or not at all mucronate, inconspicuously pilose beneath, mostly glabrous above; rameal leaves similar to the upper cauline, often very small: fruits mostly clustered, at times scattered or even secund: pedicels 1–2 mm. long, sparsely subappressed-pilose: calyx pyriform, with a short, pale nearly glabrous obconic base, 1.6–2 mm. long, 1.2–1.5 mm. broad; inner sepals brownish-green, subappressed-pilose, distinctly keeled, narrowly elliptic-ovate, obtuse, abruptly narrowed near base; outer sepals bright-green, narrowly lanceolate to linear, equaling to considerably exceeding the inner ones: capsule about equaling the calyx, lustrous, ellipsoid-ovoid to elongate-ellipsoid, often appearing slightly inequilateral; the valves slightly unequal in length or breadth or both: seeds 2–3, light- to dark-brown, dull, 0.9–1.1 mm. long, narrowly elliptic-ovate to lanceolate, subacute, nearly equilateral, dorsi-ventrally compressed, but slightly convex dorsally and flattened beneath or obscurely 3-sided and conspicuously angled ventrally.—Sp. Pl. 90 (1753); Britton in Bull. Torr. Bot. Cl. xxi. 247 (1894); Britton in Britton & Brown, Ill. Fl. ii. 442, fig. 2475 (1897); Britton, Man. 632 (1901); Grosser in Engler, Pflanzenr. iv¹⁹³. 135 (1903); Small, Fl. 798 (1903); Robinson & Fernald in Gray's Man. ed. 7: 578 (1908); Stone, Pl. So. N. J. ii. 562, pl. 83, fig. 3 (1911); Small, Man. 882 (1933). *L. thymifolia* Michx. Fl. Bor.-Am. i. 77 (1803); Elliott, Sk. Bot. S. Car. & Ga. i. 185 (1816); Smith in Rees's Cycl. xx. (1819); Leggett in Bull. Torr. Bot. Cl. vi. 251 (1878); Chapman, Fl. So. U. S. ed. 2, Suppl. 678 (1892) and ed. 3: 37 (1897); not Pursh. *L. Novae-Caesareae* Austin in Gray, Man. ed. 5: 81 (1867); Wood, Am. Bot. & Florist, 47 (1870).—The Coastal Plain and inland in river-valleys, Massachusetts to Louisiana, in the mountain regions of North Carolina, Kentucky, Tennessee and Alabama, and in the region of the lower Great Lakes. I shall omit citing specimens of this clearly defined and unusually constant species. MAP 5.

In 1894, Britton¹ discussed the typification of the quite inadequately diagnosed Linnean *Lechea minor*. There are, according to Britton,

¹ Bull. Torr. Bot. Cl. xxi. 247 (1894).

several species represented in the Linnean Herbarium. The only specimen, however, which is directly referable to the description is the one marked, "Capraria fol. integerrimis, fl. virg.," this phrase also being cited after Linnaeus' very brief description of *L. minor*.¹ Britton chose this specimen for the TYPE of *L. minor*. It is the plant with which we are here concerned.

Until Britton cleared up the situation the name *Lechea minor* was regularly applied to at least two others of our northeastern species, *L. Leggettii* and *L. intermedia*, and, at times, to *L. tenuifolia*, *L. maritima* and *L. racemulosa*. Under the separate treatment of these will be found further discussions of their identification with *L. minor*.

Lechea thymifolia of Michaux is difficult to place by its very brief description, but Leggett,² under his discussion of this species, remarks, "distinguished by its long outer sepals, and leafy panicle. I have received a fragment of Michaux's specimen by the kindness of Prof. Decaisne". On the basis of Leggett's statement I admit this name in the synonymy of *L. minor* L. The greater number of American authors since Michaux and to the time of Britton, excepting Pursh, followed Michaux in using the name *L. thymifolia* for the species here treated as *L. minor*.

Lechea novae-caesareae Austin is, as shown by the type material, referable to our *L. minor*.

Grosser³ cites as synonyms of *Lechea minor* L. Rafinesque's *L. secundiflora*, *L. pauciflora*, *L. brevifolia* and *L. uniflora*. Recourse to their original descriptions⁴ shows that not one would apply to the plant we know as *L. minor* L. and which Grosser clearly described in the monograph, l. c. *L. secundiflora* has, "leaves scattered, lax, narrow, linear . . . flowers remote secund," characters which delineate *L. tenuifolia*, inasmuch as the remainder of the description clearly applies to it. *L. pauciflora* with "leaves scattered, slender, linear cuneate . . . small plant only 3 inches high" is apparently an ecological variant of some other species which, in the complete absence of other pertinent data, is unrecognizable. *L. brevifolia* is closer to *L. minor* L. Portions of the description, "leaves scattered petiolate short lanceolate or oblong ciliolate mucronate," apply to our species but by the phrase "flowers secund, pedicels equal" Rafinesque again

¹ Sp. Pl. i. 90 (1753).

² Bull. Torr. Bot. Cl. vi. 251 (1878).

³ Engler, Pflanzenr. iv¹⁹³. 135 (1903).

⁴ New Fl. N. Am. i. 95, 96 (1836).

shows that he probably had a confused notion of the plant he described. *L. uniflora* is an extraordinary form which Rafinesque saw in his travels, "Summits of the Alleghany Mts. of Maryland disc. 1825, only 3 or 4 ins. high, only 5 or 6 leaves and one or 2 flowers, capsule commonly with 6 oval seeds." It is hopeless to try to identify this particular one of Rafinesque's *Lecheas*.

One species, *Lechea stellata*, cited under *L. minor* L. by Grosser, may be taken to fit our conception of *L. minor* L. Rafinesque's description, in part, "leaves 3-4 nate petiolate, elliptic mucronate, upper leaves alternate lanceolate . . . pedicels shorter . . . external sepals very long," applies to *L. minor* L. and no other. The "pedicels shorter" is in relation to the length of the flower. Leggett, discussing Rafinesque's treatment, states of *L. stellata*, "this is undoubtedly the *L. thymifolia* of Michaux, Pursh, Smith, etc., the *Nova-Caesarea* Austin."

Lechea minor, like *L. racemulosa*, though a Coastal Plain species, is found also on some of the Appalachian summits and near Lakes Erie and Michigan. Unlike *L. racemulosa*, however, it has succeeded either in establishing itself in New England since the Wisconsin or in maintaining itself there in more favored localities during that phase of glaciation. Its localization in New England and the fact that on Cape Cod it is growing, most frequently, in company with ancient genera of the Coastal Plain (*Aletris*, *Lachnanthes*, *Drosera*, sect. *Indicae*, etc.) indicate that it probably has not migrated northward from the southern limits of the latest Wisconsin advances of ice. Furthermore, *L. minor* varies very little, having produced no geographical varieties in recent time, despite its occurrence in such widely separated and dissimilar localities. It is in no sense a weedy species. The specimens which I have seen on Cape Cod are mostly restricted to narrow borders on the upper shores of the ponds so numerous in that region. They are in no sense adaptable or aggressive as are *L. villosa*, *L. intermedia* and *L. maritima*.

4. *L. PATULA* Legg. Plant dull-green, subherbaceous, with a simple to slightly branching caudex, or suffruticose and with annual upper branches: basal shoots of the subherbaceous plants and new branches of the suffruticose plants appearing in winter; leaves of the early or resting shoots narrowly elliptic to narrowly oblong, acute, 3-5 mm. long, 0.7- slightly more than 1 mm. wide, prominently and finely pilose beneath with mostly spreading short hairs on midrib and margin, frequently sparingly so elsewhere, glabrous on the upper surface:

leaves of the developing shoots large, frequently 1–1.5 cm. long, spatulate-oblong to lance-elliptic, slightly pilose above: fruiting plants 15–70 cm. high, the short plants densely and closely branched, the tall ones openly spreading-branched: flowers scattered-racemose on the straight and mostly spreading secondary and tertiary branches or crowded toward their tips: stamens few, variable in number (often 6): flowering period often of considerable duration, both mature fruit and flowers occurring simultaneously on old woody plants: fruits scattered-racemose to crowded: pedicels less than 2 mm. long (often about 1.5 mm.), sparsely subappressed- to spreading-pilose: calyx sparsely pilose to nearly glabrous, distinctly pyriform, somewhat spreading, not clasping the capsule; inner sepals slightly concave, lance- to narrowly oblong-elliptic, obtuse; exterior sepals linear, equalling to exceeding the inner: capsule with a broad blunt apex, elongate-ellipsoid to -obovoid, 1.6–1.9 mm. long, 0.9–1.1 mm. broad, considerably exceeding the calyx; the valves in maturity splitting apart only toward the apex: seeds 1 (2), dark-brown, with embryo not visible, subequilateral, slenderly ovoid or somewhat compressed dorsiventrally, 1–1.2 mm. long, about half as broad.—Bull. Torr. Bot. Cl. vi. 251 (1878); Britton in Bull. Torr. Bot. Cl. xxi. 250 (1894); Robinson in Gray, Syn. Fl. N. Am. i¹. 194 (1895); Chapman, Fl. So. U. S. 37 (1897); Grosser in Engler, Pflanzenr. iv¹⁹³. 138 (1903); Small, Fl. 799 (1903) and Man. 882 (1933), including *L. exserta* Small, Man. 882 (1933) and *L. prismatica* Small, Man. 882 (1933).—Sandy soil, often in pine forests, South Carolina to Florida and Mississippi, frequently inland. The following are characteristic. SOUTH CAROLINA: Camden, Kershaw Co., *H. D. House*, no. 2641 (US); Aiken, August 1, 1873, *Ravenel*. GEORGIA: sand flats between Savannah and Bonaventure, August 31, 1913, *B. M. Duggar* (Mo); dry pine-barrens, Leslie, *Harper*, no. 485; dry pine-barrens along Spring Creek, near Brinson, Decatur Co., *Harper*, no. 1927; dry sand near open pond, Decatur Co., *Harper*, no. 1206. FLORIDA: Jacksonville, 1873, *H. D. Keeler*; dry sandy pine-barrens, *Chapman*, no. 4134; dry pine-barrens, Duval Co., *Curtiss*, no. 232** (TYPE, Herb. N. Y. Bot. Gard.); Lake City, Columbia Co., *Nash*, no. 2490; St. Augustine, January, 1873, *M. C. Reynolds* (NY); Huckleberry Creek, Apalachicola, October 26, 1893, *Chapman* (Mo); sand-dunes, Daytona to Mosquito Inlet, Volusia Co., *Small & DeWinkeler*, no. 9710 (NY); dry pine-barrens, Eau Gallie, *Curtiss*, no. 5833; Cape Canaveral, East Coast, *A. B. Burgess*, no. 614 (Field); New River, December 26, 1895–January 11, 1896, *A. S. Hitchcock* (Field); dry sandy soil, Sanford, June 28, 1920, *S. Rapp* (NY); vicinity of Eustis, Lake Co., *Nash*, no. 1599; high pine-land, Jessamine, Pasco Co., *Barnhart*, no. 2626 (Field); coastal dunes opposite Melbourne, *Small, Small & DeWinkeler*, no. 10,339 (NY); pine-lands 10 miles west of Vero, St. Lucie Co., *Small, Small & Mosier*, no. 11,098 (NY); pine-lands west of Halendale, Broward Co., *Small, DeWinkeler & Mosier*, no. 11,089 (NY), the type of *L. exserta* Small;

scrub, east of Sebring, De Soto Co., *Small & DeWinkeler*, no. 9787 (NY), the type of *L. prismatica* Small; scrub, ancient sand-dunes between Avon Park and Sebring, *Small, Small & DeWinkeler*, no. 10,753 (NY); pine-lands between Miami and Cocoanut Grove, *Small*, no. 4094 (NY); hammocks, west of Cocoanut Grove, Dade Co., *Small*, no. 7964 (NY); Miami, *Small & Nash*, no. 53 (NY). ALABAMA: sandy pine-ridges, Springhill, October 4, 1894, *Mohr*, no. 11 (NY); common in woods, Spring Hill, *Bush*, no. 162 (US). MISSISSIPPI: Pass Christian, July, 1881, *Langlois* (Field); Horn Island, July 25, 1897, *C. F. Baker*, no. 688 (NY); Horn Island, Biloxi, July 16, 1894, *Tracy* (NY); very dry open soil in pine woods, Biloxi, October 7, 1896, *Kearney* (US). MAP 6.

Leggett's discussion of *Lechea patula*¹ is clear and complete enough to diagnose that species. No types were indicated. Leggett stated, however, that the name *patula* referred "to the broadly spreading branches and branchlets in specimens from S. Carolina." I have seen none of Rugel's specimens, which are mentioned by Britton² and by Grosser.³ Britton states that the TYPE is in the Columbia College Herbarium but cites no specimens. None of the specimens in the herbarium of the New York Botanical Garden are marked "nov. spec." but several in the Gray Herbarium are so marked. Of the specimens cited by monographers of the genus *Lechea* since 1878 that of *Curtiss*, "Duval Co., Florida, N. Am. Pl. no. 232**", is an excellent example. Because of this and the fact that it is in the most important herbaria, I have selected it as the TYPE.

Grosser,⁴ following the Index Kewensis, lists *Lechea sessilifolia* Raf. as a synonym of *L. patula*. Rafinesque⁵ described *L. sessilifolia* as having "sessile flowers." It is placed in his subgenus *Eudicxa*, having, among other characteristics, "3-9 seeds." Quite obviously this is not *L. patula*, which usually has 1, but occasionally 2 seeds in a single capsule, never more, to my knowledge.

Lechea patula, like the other partly shrubby *Lecheas* of the southeastern United States, is astonishingly variable in the size and shape of the leaves produced at different stages of growth. The rather striking and sharp contrast in basal and cauline leaves met with in more northern species is quite lacking in this species, in which growth may and does occur throughout the year. By slow and constant

¹ Bull. Torr. Bot. Cl. vi. 251 (1878).

² Bull. Torr. Bot. Cl. xxi. 250 (1894).

³ Engler, Pflanzenr. iv¹⁹³. 138 (1903).

⁴ Engler, Pflanzenr. iv¹⁹³. 138 (1903).

⁵ New Fl. N. Am. 97 (1836).

differentiation, the shoots often develop with hardly any rest-period. They may arise either from the base of the plant or from higher on the stem or branches. Two genetically similar plants would be quite dissimilar in leaf-size and -shape at different seasons of the year. It is not surprising, then, that Small¹ has described two species which, after an extended comparative study, I find are but growth-phases of *L. patula*. Both are from southern Florida, in a winterless climate which obviously causes a greater and more extended vegetative (woody) growth to take place than is possible, for example, in South Carolina. Both are striking enough as individuals to warrant attention.

In the description of *Lechea prismatica*, Small mentions “. . . basal shoots with narrowly linear-elliptic to linear-spatulate leaf-blades.” On the type-specimen (scrub, east of Sebring, De Soto Co., *Small & DeWinkeler*, no. 9787), there are no basal shoots, so-called, but the other collection representing the species (scrub, ancient sand-dunes between Avon Park and Sebring, *Small, Small & DeWinkeler*, no. 10,753) consists of a specimen with well developed (very advanced) young shoots which are producing the nearly mature foliage described by Small in the above passage. A few lingering lance-elliptic leaves indicate that the development of the shoot is that typical of *L. patula*.

Except in the greater limits of size attributed to *Lechea prismatica* by Small his descriptions of this species and of *L. patula* are very similar. The only distinguishing features mentioned are (1) “the ellipsoid-prismatic capsule” of *L. prismatica*, contrasted with the “oval often broadly so” capsule of *L. patula* (hardly a significant difference to one who is acquainted with the variation within certain limits of a single structure in this or any other species of *Lechea*) and (2) the “very long outer sepals” of the former, contrasted with the “shorter ones” of *L. patula* (here again not an important feature, except as we can compare the length of sepals with some other part of the same plant). It may be that Small has something here worthy of varietal or specific rank. Until more material has been collected and the vegetative development shown to produce plants which differ essentially from *L. patula*, in comparative stages of growth, I must consider the plant to belong to *L. patula*. Small himself collected a specimen (coastal-dunes opposite Melbourne, no. 10,339) which he did not name but which closely resembles the specimens he labeled *L. prismatica*.

¹ Man. 882 (1933).

Lechea exserta Small, l. c., is represented by one sheet (pine-lands west of Halendale, Broward Co., Small, *DeWinkeler & Mosier*, no. 11,089). The specimen lacks developing shoots and appears definitely to be *L. patula* in a robust and highly fertile form. On this specimen the exterior sepals reach the lower limit of size for the species. Without more material of a similar character I hesitate to call this anything but *L. patula*.

Nearly all of the South Carolina, Mississippi and Alabama specimens which, at first glance, appear to be distinct from those of Small's collecting were collected during the summer or early fall. Small's plants were invariably of late fall or winter. The difference would be conspicuous inasmuch as *L. patula* matures its fruit over a considerable period of time and undergoes progressive transformations (above described) in the size and shape of its leaves.

When all of these facts are taken into consideration we must bring together under one species (*Lechea patula*) the material described by Small as *L. prismatica* and *L. exserta*, as well as the somewhat diversified group of plants having the pronounced characteristics of the type.

5. *L. TRIPETALA* (Moç. & Sess.) Britton. Caudex woody, extensive, usually multicipital, mostly decumbent, its branches generally devoid of leaves but in the spring sending forth densely pilose shoots bearing leaves essentially similar to but smaller than the adult foliage; these shoots developing immediately (without a rest-period) into the erect to semi-prostrate annual or perennial flowering stems: flowering stems numerous, bearing fine wiry branches from below the middle, densely leafy, sparsely pilose with mostly fine spreading hairs below and with more appressed hairs above and on the branches: panicles with spreading branches interlaced to form a broad depressed-globular crown, 15–20 cm. tall, frequently of greater breadth; lower branches with secondary branches, the uppermost simple: cauline and rameal leaves linear, abruptly subacute at both apex and base, 6–12 mm. long, 0.7–1.3 mm. broad, pilose with somewhat spreading hairs on the lower surface, most abundantly so on the midrib, slightly pilose to glabrous above: fruits mostly secund, particularly on the upper simple branches, on occasional plants mainly clustered: pedicels 2–3 mm. long, slender, suberect to spreading, pilose with mostly appressed hairs; calyx somewhat deltoid and depressed-globose, broadest near the base, 2.3–2.6 mm. broad, 2–2.2 mm. long, evenly subappressed-pilose; interior sepals ovate, about as broad as long, strongly keeled; exterior sepals usually exceeding the interior, 2–3.5 mm. long, linear and abruptly acute, subappressed-pilose: capsule depressed-globose, broadest toward the base, 2–2.3 mm. broad, not more than 2 mm. long; valves ovate, with 2 slight longitudinal ridges, one on each side

of the median line, marking the position of the enclosed seed; placentae and dissepiments persistent, fragile, retaining their position and structure in the mature capsule: seeds usually 6, occasionally 4, brown, smooth, with embryo not evident, uniformly rounded, dorsally angled, ventrally with one nearly flat lateral face (that next the contiguous seed), the other side (toward the dissepiment) convex.—Bull. Torr. Bot. Cl. xxi. 252 (1894); Grosser in Engler, Pflanzenr. iv¹⁹³. 139 (1903), *Helianthemum tripetalum* Moç. & Sess. in Dunal in DC. Prodr. i. 284 (1824). *Lechea Skinneri* Benth. Bot. Sulph. Voy. 66 (1844); Walp. Rep. Bot. v. 58 (1845–46); Hemsley in Biol. Centr. Am. i. 46 (Sept., 1879); C. Conzatti, Los Géneros Veg. Mex. 85 (1903). *L. depressa* Jones, Contrib. West. Bot. no. 18: 59 (1933).—Oklahoma (one station, Pawhuska); north-central Mexico and southern Baja California, south through the mountains of central and southwestern Mexico to Guatemala, mainly at high altitudes (600–2600 m.). OKLAHOMA: on dry rocky ledges, near Pawhuska, Osage Co., G. W. Stevens, no. 2004 (NY). SAN LUIS POTOSI: 6000–8000 ft., 1878, Parry & Palmer, no. 31; in montibus San Rafael, Schaffner, no. 604. GUANAJUATO: hillsides near Acambaro, Pringle, no. 11,923. JALISCO: thin gravelly soil of hills, near Guadalajara, Pringle, no. 4476; Rio Blanco, near Guadalajara, Pringle, no. 5171. MICHOACAN: vicinity of Morelia, Loma Sta. Maria, alt. 2000 m., G. Arsène, no. 7354 (as *L. Drummondii*); Loma Sta. Maria, alt. 2000 m., Arsène, no. 8584 (US) (as *L. Drummondii*); Loma Sta. Maria, alt. 2000 m., Arsène, no. 5973 (Mo) (as *L. Drummondii*); Jesus del Monte, Morelia, alt. 1910 m., Arsène, no. 3181 (US); Cerro San Miguel, vicinity of Morelia, alt. 2100 m., Arsène, no. 10,115 (US). PUEBLA: dry ground (alta Luz), Puebla, Purpus, no. 2744. OAXACA: Sierra de San Felipe, alt. between 7000 and 8000 ft., C. L. Smith, no. 814 (NY); alt. 1750 m., Conzatti & Gonzalez, no. 1014 (US); Combte de Taha, 1841–1843, Liebmann, no. 3151 (US). BAJA CALIFORNIA: La Chuparesa, Brandegee, no. 16; Sierra San Francisquito, December 1, 1899, Brandegee (NY); the Laguna, Laguna Mountains, M. E. Jones, no. 27,117 (as *L. depressa*, n. sp.). GUATEMALA: September, 1921, Tonduz, no. 612 (NY); Traderas Aridas (de Guatemala), 1400 m. alt., July, 1931, Tonduz, no. 612 (US). PLATE 489, FIG. 11; MAP 7.

The plate of Moçino and Sesse¹ to which Dunal refers in his description² is without doubt a *Lechea*. The long narrow exterior sepals serve to identify it with what has usually been called *L. Skinneri* Benth. The only other Mexican species in the genus, *L. villosa* var. *Schaffneri*, has lanceolate leaves and is decidedly more densely branched and strict than is the plant in the illustration. *L. depressa* Jones is a somewhat depauperate semiprostrate plant which in all essential characters is like *L. tripetala*.

¹ Moçino & Sesse, Fl. Mex. Ic. (ined.)

² DC. Prodr. i. 284 (1824).

Lechea tripetala has been confused to a certain extent with *L. san-sabeana* which it resembles in size and shape of calyx, exterior sepals and capsule, length of pedicel and arrangement of fruits. This is usually secund in *L. tripetala* and always so in *L. san-sabeana*. Certain differences are equally well marked. The branching is dense in the former, sparse in the latter. The caudex, which is extensive and often decumbent in *L. tripetala*, is erect and but slightly if at all branched in *L. san-sabeana*. The pendulous fruits of the latter, which are borne on very slender pedicels 3 or more mm. long, and the persistent and firm yellow placentae and dissepiments, which partition off and partly inclose the two seeds opposite each valve, make *L. san-sabeana* utterly distinct from all others. *L. tripetala*, its closest relative, has long, often spreading pedicels and pale-red dissepiments which, though fragile, are definite and persistent structures. *L. san-sabeana* is confined to low altitudes in eastern and southeastern Texas. *L. tripetala*, except for the extraordinary occurrence at one station in Oklahoma, is found only from San Luis Potosi and southern Baja California southward into Guatemala. Many, if not all of these Mexican and Central American stations, are at altitudes of 1000 meters or more as indicated on the labels.

Lechea tripetala, with 6 (occasionally 4) seeds, is closely related to the variety *occidentalis* of *L. tenuifolia*, which has 2 seeds and smaller fruits on less spreading branches. *L. tenuifolia* and its western variety *occidentalis*, *L. mensalis* of western Texas, *L. tripetala*, mostly of Mexico, and *L. san-sabeana*, confined to areas of low altitude in Texas, constitute a well-marked division of the genus, uniformly characterized by having narrow cauline leaves and narrow basal leaves (when present), the exterior sepals longer than the interior and the capsule and calyx either depressed-globose and broadest near the base or, if elongated, with the basal part broader than the upper half. The pedicels are mostly as long as or much longer than the mature calyces and the flowers and fruits are loosely racemose along the branches (not crowded at the tip). The presence of *L. tripetala* in three widely separated areas, Oklahoma, Baja California and the mountains of central and southern Mexico and of Guatemala, indicates an early origin and spread followed by a later decline, leaving widely separated stations to mark its once considerable range and abundance. Johnston,¹ p. 966, in a discussion of the *Relationship and Origins of the Biota*

¹ Proc. Cal. Acad. Sci. xii. 966-969 (1924).

of Lower California, where *L. tripetala* is found, states of the Peninsula, "the southern two thirds has a flora clearly and definitely allied to and derived from the flora now occupying Sinaloa, southern Sonora, and the states of southern Mexico." The area mainly occupied by *L. tripetala* on the Peninsula is the Cape region of which Johnston says, l. c. pp. 968, 969. "The cape region seems to be a very old area, and appears to have escaped complete submergence since its initial elevation early in the Tertiary. During the long periods previous to the Pliocene the cape region was separated from California by a long stretch of water, for at that time the strata of the present volcanic plateau were horizontal and still under the sea. The cape region of Tertiary times was probably a larger area than now and connected for a time with the Mexican mainland. While joined easterly to the Mexican coast, the fauna and flora of that region gained access to the cape region. Among many other species the ancestors of the southerly derived reptiles, the *Oryzomys*, and the heavy-seeded montane trees, such as *Pinus*, *Quercus*, and *Arbutus*, came over on the Tertiary land connection." In matters of distribution *Lechea* probably belongs in the same category as the heavy-seeded montane trees. Its seeds, though small, are solid and perfectly smooth and therefore not adapted to wind-dissemination. Their smallness (1 mm. long) and probable scarcity make it seem unlikely that seed-eating birds have carried the species to Baja California. Its capsules are similarly not adapted to popularly conceived notions of dissemination. A land-connection would, I believe, be necessary to bring about this distribution. The presence of the plant toward the north in the Sierra San Francisquito might perhaps be explained by a later migration northward when land-connections in that direction were subsequently resumed. It seems more plausible to me to assume that here again is an instance of an area included in the early range of the species. Grabau¹ shows a land connection to have been present in Eocene time between the cape region of Lower California and the mainland of Mexico, a connection which was severed in Oligocene time. The intruding seas of that period have persisted to present time.

The tremendous "jump" of the species to the northeastern part of Oklahoma recalls the significant fact that the Ozark plateau, as noted by Fernald² and by Steyermark,³ has been in continuous existence as

¹ Textbook of Geology, part 2: 801, fig. 1835 (1921).

² *Specific Segregations and Identities in some Floras of Eastern North America and the Old World*. RHODORA, xxxiii. 25-27 (1931).

³ RHODORA, xxxvi. 231-233 (1934).

a land-area since the close of the Paleozoic era. Speaking of those ancient species which are restricted to the Ozark Plateau and to the adjacent area to the west and southwest, Steyermark, p. 231, states, "In some instances species originating in this area are represented slightly to the east or southeast of the main area, but have spread mostly westward and southwestward; some of this class are found as far south as the Mexican plateau or as far west as Arizona." Comparing this class with that comprising the species common to the southern Appalachians, Steyermark, p. 233, concludes that it is "a younger flora, characteristic of the uplands and barrens of the Ozarks, a flora which probably originated in Tertiary times when this region was re-elevated in late Tertiary."

Though Steyermark places the time of establishment of this class of species in the Ozark area as late Tertiary, it seems to me that, in view of the general disruption in range of *L. tripetala* and its extreme isolation in Oklahoma, it and perhaps other species mentioned by Steyermark as occurring on both the Ozark and the Mexican plateaus may well have attained their present limits of distribution in earlier Tertiary times.

(To be continued)

A NEW *JUNCUS* FROM UTAH

ROBERT F. MARTIN

JUNCUS utahensis, sp. nov. Perennis; caules ex rhizomate horizontale, 25–35 cm. alti; folia septata, compressa; inflorescentia 15–30-glomerulata; glomeruli 4–7-flores; sepala 4 mm. longa, lanceolata, subacuminata, saturate brunnea, petalis paulo longiora; petala lanceolata, acuta, saturate brunnea; stamina 6, sepalis duplo breviora; filamentum antheraque subaequalia; fructus saturate brunneus, mucronatus, obtusus, sepalis aequalis; semina caudata.

Perennial; stems arising singly or few together from a horizontal rootstock, 25–35 cm. high; sheaths with scarious margins: blades up to 18 cm. long, compressed, septate; inflorescence rather congested, of 15–30 clusters of 4–7 flowers; bracts and bracteoles light brown; sepals 4 mm. long, lanceolate, short-acuminate, chocolate-brown, a little longer than the lanceolate, similarly colored acute petals; stamens 6, about one-half the length of the sepals; filament and anther about the same length, the filament narrower; capsule oblong, blunt below the mucronation, chocolate-brown, about the length of the sepals; seeds white-tailed, light reddish-brown, striate, 0.8 mm. long.